RESEARCH AND FARMING

SIXTY-EIGHTH ANNUAL REPORT

Agricultural Experiment Station
North Carolina State College of
Agriculture and Engineering of
The University of North Carolina

1945

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L. D. Baver, *Dean of Agriculture and*
Director, Agricultural Experiment Station

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Fiscal Period July 1, 1944-June 30, 1945
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STATE INSTITUTIONS COOPERATING IN AGRICULTURAL RESEARCH

State College of Agriculture and Engineering Of The University of North Carolina

Frank P. Graham, *President*
J. W. Harrelson, *Chancellor*
L. D. Baver, *Dean of Agriculture*

N. C. Department of Agriculture Raleigh, N. C.

W. Kerr Scott, *Commissioner*
F. E. Miller, *Director of Branch Stations**

* The six branch station farms are owned and operated by the North Carolina Department of Agriculture, and the employees on these farms are members of the Department of Agriculture staff.

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To the Governor of North Carolina, the Board of Trustees and President of the University of North Carolina and the Chancellor of the North Carolina State College of Agriculture and Engineering:

I am transmitting herewith the report of the Agricultural Experiment Station for the year ending June 30, 1945.

Respectfully submitted,

L D Baver

Director,
NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION.

AGRICULTURAL ENGINEERING

Drying and Processing Hybrid Corn Seed

Three plants for artificially drying hybrid corn seed were constructed in North Carolina during the summer of 1945. One of these plants is located at the Speight Seed Farm, Winterville, in Pitt County; another at the Farmers Cooperative Exchange, Statesville, in Iredell County; and the third is an experimental plant at McCullers. The use of these three plants has definitely established their need and value in combatting insect damage and providing a high quality seed.

The moisture content of the corn, when harvested to prevent insect damage, will range from 25 to 35 per cent or higher. At this stage the corn can be husked but is too soft to shell and the kernels must be dried on the cob. Within three to five days after harvesting it must be dried down to 12 per cent moisture content for safe bulk storage.

This rate or drying will necessarily involve the use of forced air with artificial heat. To prevent damage to the corn germ the temperature of the drying air should never be allowed to go above 110 degrees F. If rainy or foggy weather prevails during the drying period the temperature of the drying air should be kept at 110 degrees F., otherwise it can be dropped to 100 degrees F. for a more efficient use of fuel without danger of mold or rot damage to the corn.

It is more economical of labor and fuel to dry corn in a series of bins, filling the bins successively. Usually not less than four bins will be found desirable, and drying is started as soon as the first bin is filled. By the time the second bin is filled the corn in the first bin will be dried to a point where the drying air needed will be only a fraction of that required at the beginning of drying. The size, capacity and first cost of the heating and blowing equipment is much less for this method of drying than would be the case if the entire crop were dried in one bulk.

There is always a considerable saving in labor needed, if the sorting, shelling, cleaning, grading, treating, bagging, and storage of the seed corn is provided for in the same building where the drying is done. A two—or preferably three-story building is ideal for this purpose. The use of one or two small grain elevators together with gravity chutes from hopper-bottom storage bins will provide a most efficient use of labor at a comparatively lower cost. The grower producing

2,000 or more bushels of seed corn each year will find that the careful planning of such a processing plant will be time well spent.

Two tests, using tobacco barns (Fig. 1) for drying hybrid seed corn were made, with the following conclusions: 1. Too slow for safe drying of more than 200 to 300 bushels of seed harvested early to prevent insect damage, 2. Laborious and hazardous even with constant attention, 3. The average tobacco barn will not safely withstand a load of more than 200 to 300 bushels of corn of 35 per cent moisture content, 4. The conventional tobacco barn furnace is one of poor design and construction to furnish heat for drying as outlined above, and 5. The method as a whole is too risky for general recommendation.

A Study of Surface and Subsurface Drainage

Recently a joint research project was begun by the Agricultural Engineering Department and the Research Division of the Soil Conservation Service to study the efficiency of the existing drainage practices, and to install new installations and study their efficiency. Thus, the most practical means of draining North Carolina soils, particularly those with a high potential fertility, which are difficult to drain, could be determined.

For the new installations, tile drains, v-ditches, bed drains, and open ditches will be installed over a wide range of soil conditions ranging from light textured to the heavy plastic soils. The depth and spacing of these drainage systems will vary on each soil.

The major outlets and a large number of small field ditches will be constructed with dynamite (Fig. 2). A comparison of drainage efficiency between mechanically constructed ditches and dynamited ditches will be made.

All preliminaries have been completed and the field installations on Bladen silt loam soil have begun. A minimum of seven more of these experiments will be installed on the various soils as quickly as possible.

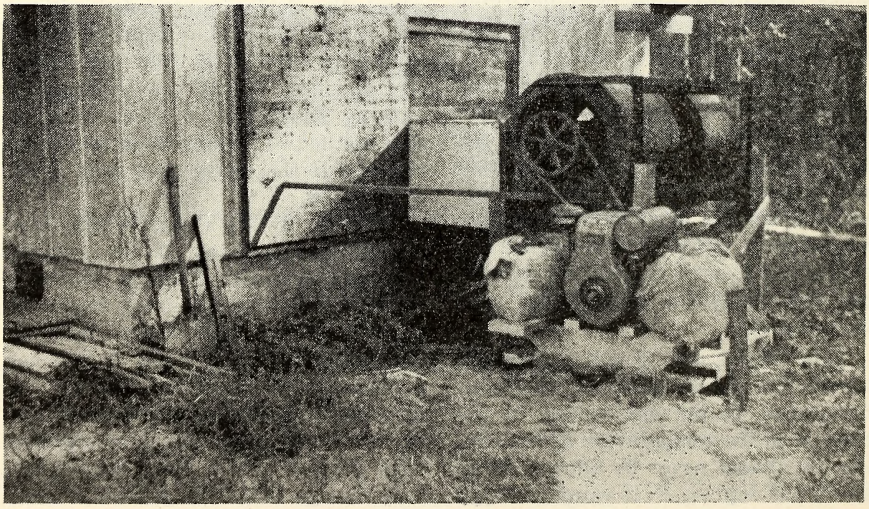


FIG. 1. TWIN-BLOWER UNIT CONNECTED TO SIDE OF FLUE-HEATED TOBACCO BARN FOR EXPERIMENTAL STUDIES OF DRYING HYBRID CORN SEED.

FIG. 2. A TYPICAL DRAINAGE DITCH NEWLY CONSTRUCTED WITH DYNAMITE.

Curing and Storage of Sweet Potatoes

Because of the leading position which North Carolina has taken in recent years in the production of sweet potatoes, and in an effort to reduce the cost of and increase the quality of curing, an experimental curing and storage house of 1,000-bushel capacity has just been completed at McCullers. The house is divided in the middle, one end being heated by electricity with provisions for automatic control of temperature, humidity, and ventilation. For comparison, the other end of the house is equipped so that it can be heated by coal, wood, oil, or bottled gas. Indications are from results obtained elsewhere that costs and curing and storage will average from 2 to 3¢ a bushel, with a minimum of 1¢ per bushel for the large houses and a maximum of 19¢ per bushel for small insulated storage compartments.

The cost of electricity for curing potatoes in any one house will vary from year to year by as much as 1 to 4¢ per bushel, because of variations in weather conditions and other factors.

An all-electric curing and storage house of 6,000-bushel capacity was built at Gibson in Scotland County during the summer of 1945. It is now filled with potatoes and appears to be operating satisfactorily.

Harvesting Sweet Potato Vines

A new farm machine, "The Vine-Row", has been developed to make

easier the harvesting of sweet potato vines for silage. The harvester shown at the top of Figure 3 straddles one hilled row of potatoes. Two sets of knives spaced approximately seven inches apart cut the vines loose from the tubers three and one-half inches in each side of the center of the row.

Concave spoked wheels set at an angle to the direction of travel and

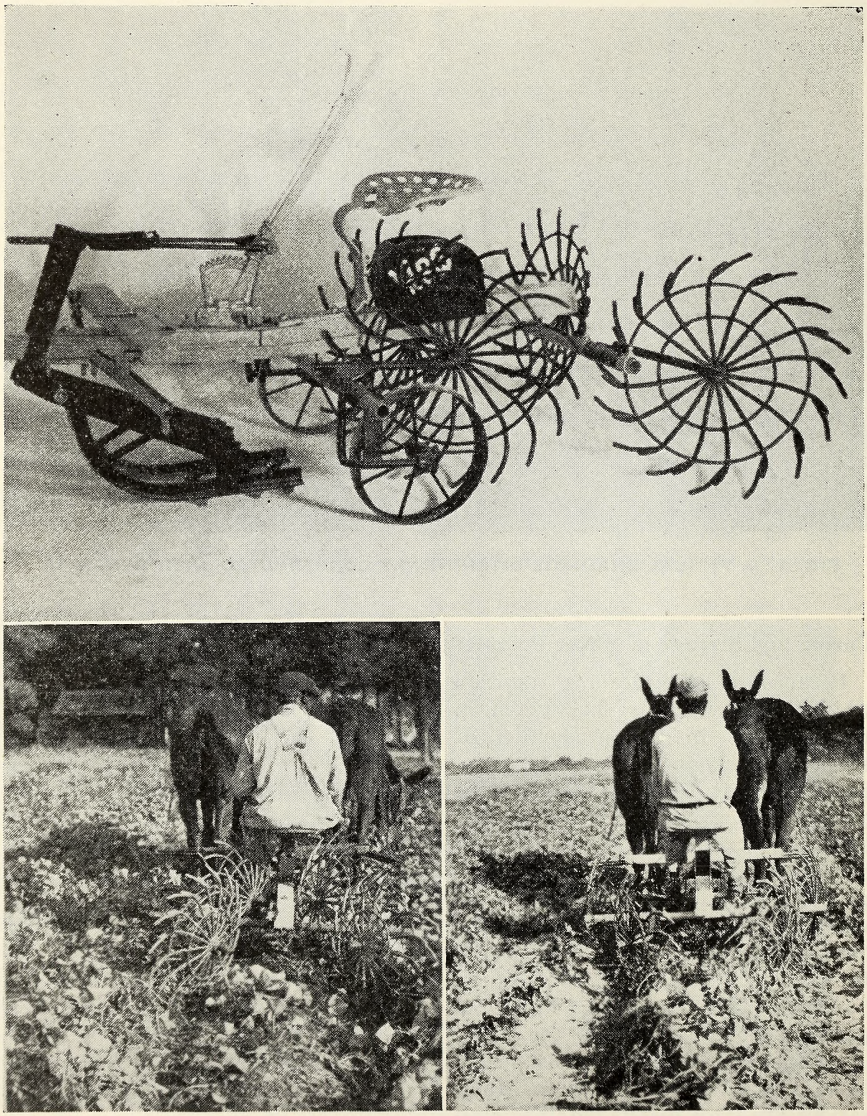


FIG. 3. TOP: VIEW OF THE "VINE-ROW" HARVESTER. LOWER LEFT: REMOVING THE VINES FROM THE ROW. LOWER RIGHT: USING THE MACHINE TO WINDROW THE VINES.

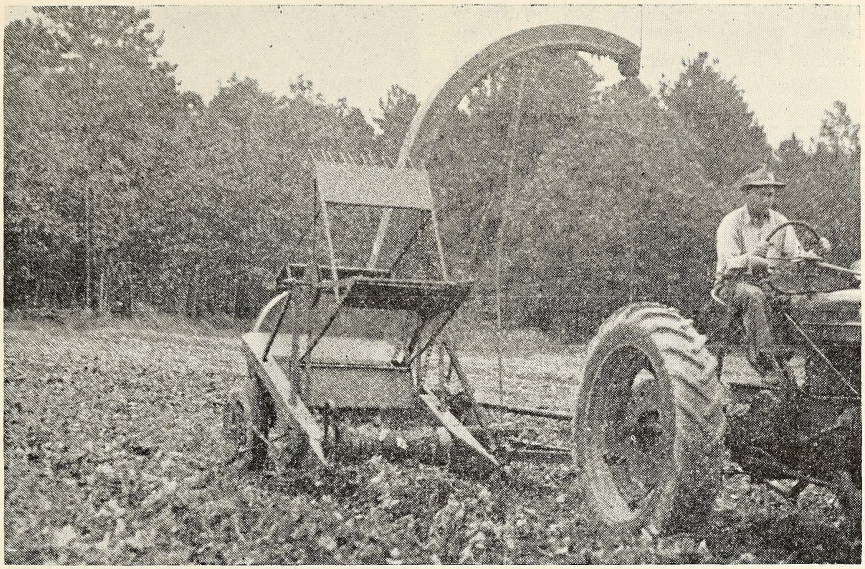


FIG. 4. A COMMERCIAL FORAGE CROP HARVESTER OR CHOPPER WILL SUCCESSFULLY PICK UP SWEET POTATO VINES IN A WINDROW.

having specially designed fingers lift the potato vines from the ground surface and move them into a windrow in the valley between the two hilled rows. This operation is shown in the lower left hand corner of Figure 3.

For the farmer with a small acreage the vines may be picked up by fork from this windrow and loaded into a wagon. The farmer with a larger acreage may use a pick-up type of forage crops harvester or cropper such as that shown in Figure 4. The lower right hand corner of Figure 3 shows the fingered wheels interchanged and the machine being used to move two windrows together on the top of a hilled row of potatoes. This resulting windrow is of a size suitable for the chopper and is in a better position to be picked up.

Use of the machine shows that approximately 80 per cent of the vines may be saved with this machine and that only 4 per cent of the tubers are damaged. The greatest part of the damage is done by the parallel knives and is only slightly more than the damage usually done at the present by vine cutters attached to the beam of a plow when the tubers are dug.

FIELD CROPS

CORN

Corn Hybrids Maintain High Records

North Carolina hybrids 1028, 1032, 1111 and 1114 averaged 68 bushels per acre in three Coastal Plain trials during 1945. This average yield of the four double cross hybrids was a 31 per cent increase over the yield of the check variety, Jarvis Golden Prolific. The same hybrids averaged 94 bushels per acre in two Piedmont trials or a 33 per cent increase above the average yield of four farm varieties.

In the Piedmont trials, North Carolina hybrids T1, T8, T1, T20 and T23 averaged 87 bushels per acre in contrast to 71 bushels per acre for the check farm varieties. The highest yield from these top cross hybrids was made by the white hybrid, N. C. T20, which averaged 96 bushels per acre.

The yellow hybrid, U. S. 282, has averaged 82.8 bushels per acre during the last four years in the Mountain trials. This hybrid has increased grain yield 17 per cent above Holcombe Prolific, the check white variety, and 44 per cent over Jarvis Golden Prolific.

Hybrid Corn Seed Production Increased Five-Fold

Approximately 15,000 bushels of North Carolina certified hybrid seed corn (of hybrid strains mentioned in preceding section) were grown in 1945, a five-fold increase over 1944. This hybrid seed supply is sufficient to plant over 100,000 acres or 5 per cent of the corn acreage in the state. Assuming that this 100,000 acres is of only average productivity, planting hybrid corn seed should net an extra 500,000 bushels of feed corn in 1946. In this work, major emphasis is being placed on production of high quality seed of adapted hybrid strains (Fig. 5).

Foundation single cross seed was increased sufficiently to allow the planting of 1,500 acres for double cross seed production in 1946. This acreage will be three times the acreage planted in 1945. Inbred strains have been increased to allow still further expansion by 1947.

A group of farmers and seedmen who are interested in good seed organized the North Carolina Foundation Seed Producers, Inc., on August 15, 1945. This organization was incorporated on a non-profit basis with its major objective to supply the best possible foundation seed of corn hybrids and of varieties of other crops released by the Experiment Station.

Operating under a Board of Trustees elected from its membership and with a full time manager, the organization assumes the responsibility of increasing any new strain of a field crop developed and released to the

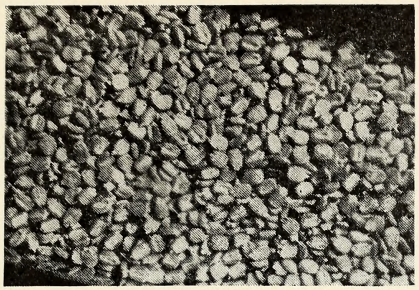


FIG. 5. A SEED SAMPLE OF N. C. CERTIFIED HYBRID 1032, SHOWING EXCELLENT SEED QUALITY. THE USE OF ARTIFICIAL DRYING HOUSES, GOOD INSECT CONTROL, SPECIAL CLEANING AND SIZING EQUIPMENT ARE AIDING GROWERS IN THE PRODUCTION OF THIS HIGH QUALITY SEED. SEED QUALITY IS ESSENTIAL IN HYBRID CORN IF THE FARMER IS TO REALIZE TO THE FULLEST EXTENT THE SUPERIORITY BRED INTO THE GERMPLASM.

organization by the North Carolina Agricultural Experiment Station. The increased seed supply will then be offered to the members of the North Carolina Crop Improvement Association who will make the final multiplication of seed and sell to the general farm public. The efforts of the new organization will bring the results of the Experiment Station program to the largest number of farmers in the shortest possible time.

New Hybrids Indicate Greater Improvement

Two new yellow corn hybrids, N. C. 26 and N. C. 27, have shown an average grain increase of 40 per cent above the check variety grown with them. The two hybrids averaged 73 bushels per acre in three Coastal Plain trials during 1945. The first seed increase of these two hybrids for farm trial was made in 1945 (Fig. 6). These are prolific types which have good root systems and fair to good husk coverage over the ear. In a strip planting made by the Speight Seed Farms at Winterville in 1945, all hybrids showed a definite increase in yield over the variety, Jarvis Golden Prolific. N. C. 27 produced 59 bushels per acre and N. C. 26 averaged 53 bushels as compared to 42.4 bushels per acre for the older hybrid, N. C. 1028.

N. C. Hybrid 2157 and N. C. Hybrid 2166 averaged 82.5 bushels and 80.5 bushels per acre, respectively, in four locations in the Coastal Plains. These two experimental white hybrids were more than five bushels better than the best hybrid now available to the farmers and more than 21 bushels better than Lathams Double, the best open-pollinated variety.

Other characteristics, such as resistance to grain weevil, are being bred into the newer hybrids. N. C. Hybrid 5002 produced not only big yields in the Lower Coastal Plain but also had very excellent grain quality which showed little weevil damage. This and other hybrids which combine both high yielding capacity and resistance to insect pests and storm damage are being tested extensively before making final selection for releasing to farm growers.

Inbred Strains Prove Inefficient Users of Nitrogen

Sixteen inbred strains of corn (the parent strains used in producing hybrid corn) were grown in a field of Norfolk Fine Sandy Loam soil in Johnston County. Three rates of nitrogen fertilizer were applied: 20 pounds, 80 pounds and 140 pounds of nitrogen per acre. Approximately 10,000 plants per acre with these rates of nitrogen produced 657 pounds, 796 pounds and 754 pounds of grain per acre, respectively (Fig. 7). A gain of 139 pounds of corn was obtained from adding 60 pounds of nitrogen (375 pounds of nitrate of soda as side dresser). This increase in yield is only 2.3 pounds of grain for each pound of the nitrogen.

FIG. 6. A PARTIAL VIEW OF AN ISOLATED CORN FIELD IN WHICH SEED IS BEING PRODUCED OF THE TWO NEW YELLOW HYBRIDS, N. C. 26 AND N. C. 27. NOTICE TASSELS HAVE ALL BEEN REMOVED FROM ALTERNATE THREE ROWS LEAVING TASSELS ON EACH FOURTH ROW. ROWS WITH TASSELS SUPPLY POLLEN FOR ENTIRE FIELD. HYBRID SEED IS PRODUCED ONLY ON THE DETASSELED ROWS, THAT IS, ON THREE-FOURTHS OF THE CROP.

The second 60 pounds of nitrogen did not increase the yield of the inbred strains of corn at all.

However, when the number of plants per acre was increased to 14,000, the application of 140 pounds of nitrogen (750 pounds of nitrate of soda) increased grain yield up to 1041 pounds per acre. Thus, with extra plants and high nitrogen rate, 4.66 pounds of grain were obtained for each pound of nitrogen added. It is quite evident that number of plants is very important in increasing yield of inbred strains of corn. Nitrogen fertilizer could only be of value when sufficient plants were present to utilize the extra fertilizer.

Corn hybrids responded in similar manner as did the inbreds when fertilized with different nitrogen rates. The first 60 pounds of nitrogen increased grain yield from 42 bushels to 65 bushels per acre. The second 60 pounds of nitrogen gave no further increase with only 6,500 plants per acre. With 10,000 plants per acre, the extra nitrogen increased yield up to 78 bushels per acre. As in the inbred test, the number of plants per acre was very important in obtaining maximum yields from corn hybrids.

Nitrogen—Most Responsive Factor

In all the fertilization experiments conducted in North Carolina, nitrogen has been found to have the greatest influence in increasing corn yields. The amount of applied nitrogen to which any given corn crop responds, however, is dependent upon the available supply of nitrogen in the soil and occurrence of other factors that will limit the yield. Nonetheless, within the range of response under any given condition, corn yields were in-

creased approximately *one bushel for each two pounds of nitrogen applied.* An example of this is given in Figure 8 where nitrogen up to the 120-pound level was responsible for increasing yields. Since the supply of minerals and soil moisture was ample, it is believed that leaf diseases limited further response.

Winter Legumes Furnish Needed Nitrogen

A good growth of Austrian winter peas (2,100 pounds dry weight per acre of top growth) grown on a Norfolk fine sandy loam increased corn yields about 40 bushels per acre (Fig. 9). This yield increase was the same as that from 60 pounds of nitrogen per acre.

In an experiment at the Upper Coastal Plain Station in 1945, hairy vetch turned under with no additional nitrogen on the corn produced a yield of 88 bushels per acre (Fig. 10). Austrian peas were not quite as effective even though just as much nitrogen was turned under in the cover crop. Additional nitrogen on the corn increased the yield after Aus-

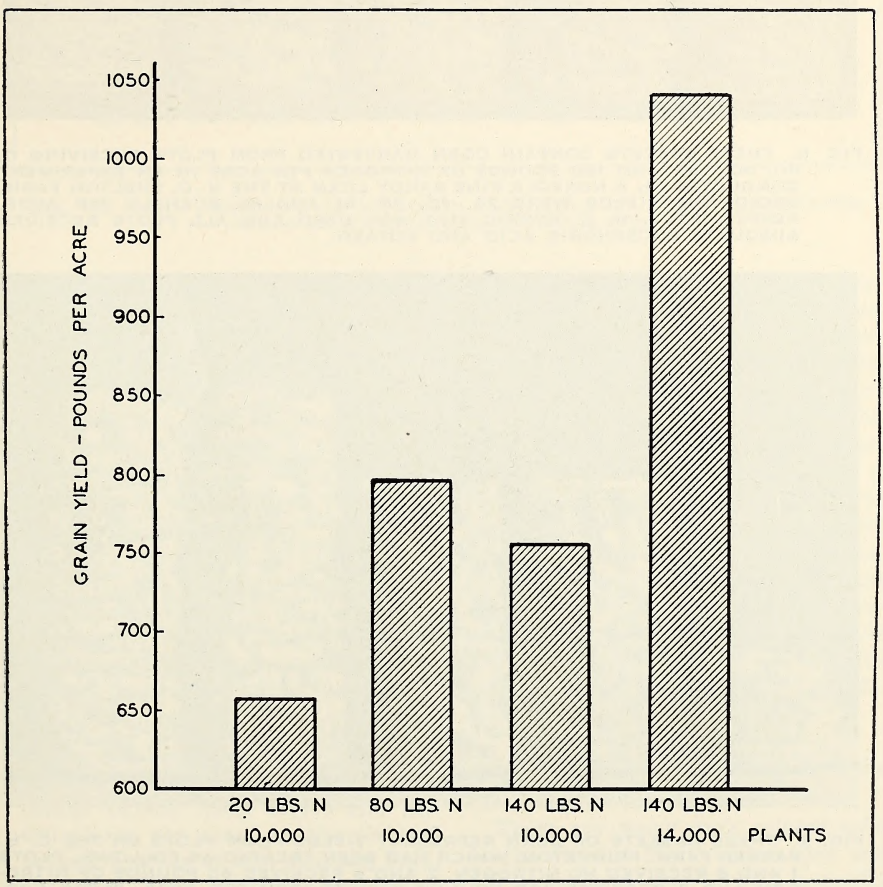


FIG. 7.

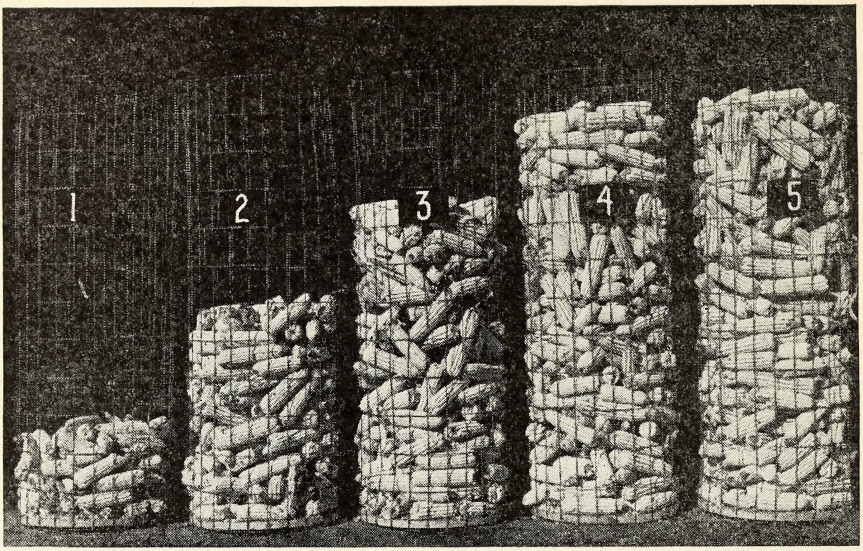


FIG. 8. THESE BASKETS CONTAIN CORN HARVESTED FROM PLOTS RECEIVING 0, 40, 80, 120, AND 160 POUNDS OF NITROGEN PER ACRE IN AN EXPERIMENT CONDUCTED ON A NORFOLK FINE SANDY LOAM AT THE H. G. SHELTON FARM, SPEED. THE YIELDS WERE 20, 40, 60, 81 AND 82 BUSHELS PER ACRE, RESPECTIVELY. N. C. HYBRID 1114 WAS USED AND ALL PLOTS RECEIVED ADEQUATE PHOSPHORIC ACID AND POTASH.

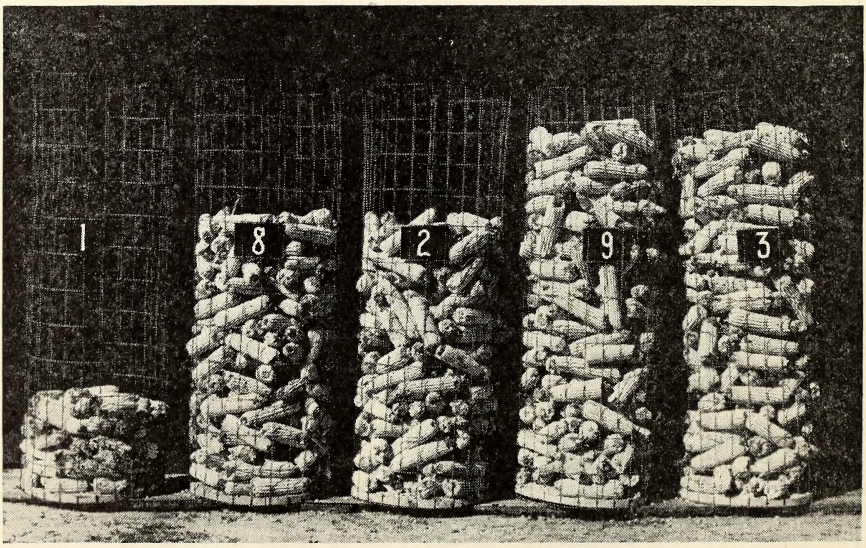


FIG. 9. THESE BASKETS OF CORN REPRESENT YIELDS FROM PLOTS ON THE C. H. PARKER FARM, PRINCETON, WHICH HAD BEEN TREATED AS FOLLOWS: PLOTS 1 AND 8 RECEIVED NO NITROGEN, 2 AND 9 RECEIVED 60 POUNDS OF NITROGEN AND 3 RECEIVED 120 POUNDS OF NITROGEN PER ACRE. PLOTS 1, 2, AND 3 FOLLOWED NO COVER, 8 AND 9 FOLLOWED AUSTRIAN WINTER PEAS. THE RESPECTIVE YIELDS WERE 17, 58, 59, 77, AND 78 BUSHELS PER ACRE.

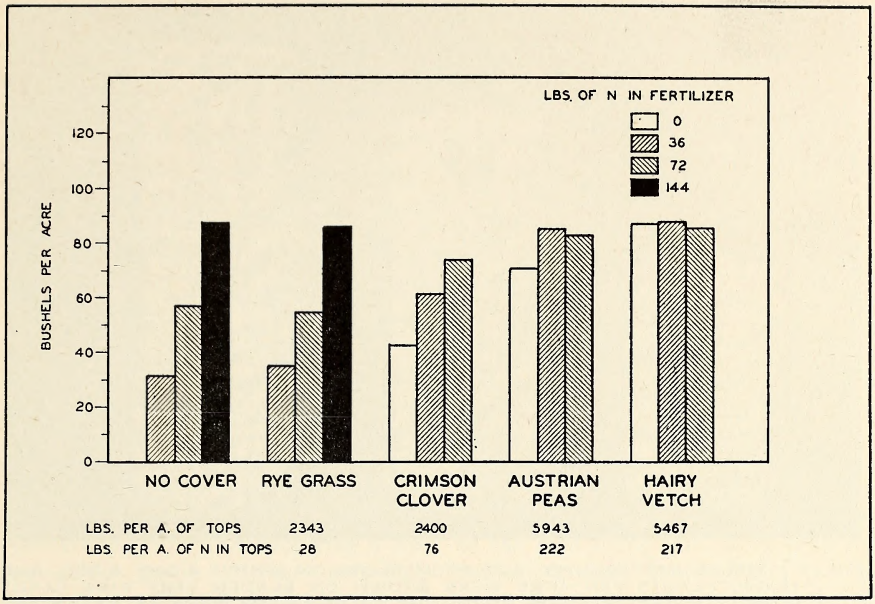


FIG. 10. CORN RESPONDS TO NITROGEN FURNISHED BY LEGUMINOUS COVER CROPS OR BY COMMERCIAL FERTILIZERS.

trian winter peas 15 bushels. There was no increase from extra nitrogen after the vetch. With no cover but with 144 pounds per acre of nitrogen (the equivalent of 900 pounds nitrate of soda) 88 bushels of corn were produced. Approximately the same yield was obtained with the 144-pound application after rye grass. Adequate phosphorus and potassium were added to the corn on all plots.

These data indicate that winter legumes are a good source of nitrogen for corn production, but usually supplemental nitrogen is necessary to produce maximum yields.

Yields Increased by Closer Spacing

In several experiments conducted to study the effect of four different stands (4,000, 7,000, 10,000 and 13,000 plants per acre) on the yield of several hybrids at low, medium, high, and very high nitrogen levels, the thickest spacing proved profitable when adequate fertilization was provided. On a Norfolk loamy sand under adequate levels of fertilization and favorable soil moisture conditions, the yields of three hybrids were increased from 58 to 73 bushels per acre as the spacing was made thicker. Likewise, even under droughty conditions on a Davidson clay loam, yields were increased from 43.5 to 54.1 bushels per acre by increasing the plant population. On a Bladen fine sandy loam under conditions of adequate fertilization and ample moisture, yields were increased 74 per cent by increasing the stand from 4,000 to 12,000 plants per acre (Fig. 11).

Experiments on Low Potash Soils Show Potash Need

There are many dark colored soils in the Coastal Plain where corn and soybeans have been grown annually for many years with little or no

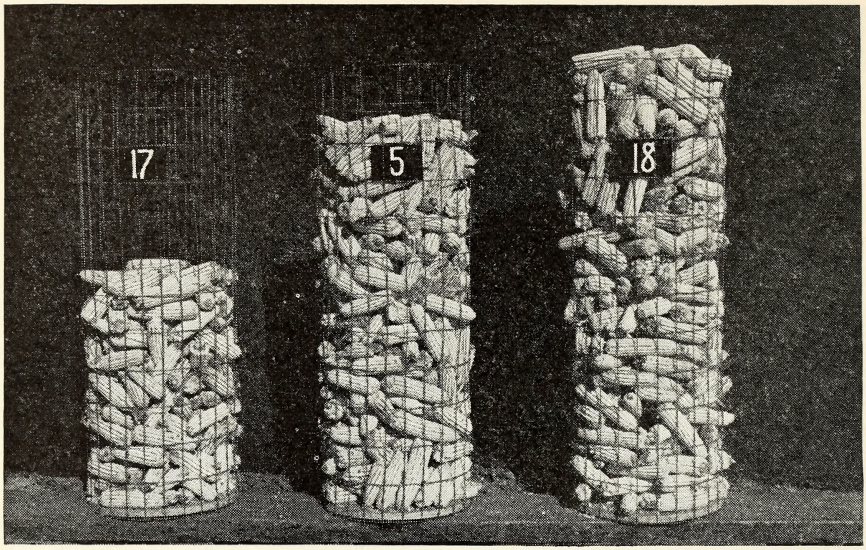


FIG. 11. YIELDS REPRESENTED ARE FROM PLOTS ON WHICH 4,000, 9,000, AND 12,000 PLANTS PER ACRE WERE GROWN ON BLADEN VERY FINE SANDY LOAM, J. V. TAYLOR FARM, PITT COUNTY. THE YIELDS WERE 53, 82, AND 93 BUSHELS PER ACRE. ALL PLOTS WERE ADEQUATELY FERTILIZED.

fertilization and as a result the available potash supply has become depleted. Several experiments were conducted on such soils which showed that additional potash is necessary.

One of these was a Coxville fine sandy loam which had annually produced about four bushels of soybeans and 10 to 20 bushels of corn per acre with the farmer's practice. In the experiment where a sufficient stand of an adapted hybrid was adequately fertilized, the corn yield was 93.4 bushels per acre. However, when potash was omitted the corn leaves showed marginal burning, the plants lodged badly, and the yield was only 62.0 bushels of poor quality corn. On another soil following four years of soybean hay, the per acre yield from plots receiving 0, 40, and 80 pounds of potash along with adequate supplies of phosphoric acid and potash were 33.2, 57.4, and 74.7, respectively. This is the only experiment where there has been any response trend for more than 40 pounds per acre of potash.

Some Response to Phosphoric Acid

In experiments on two Piedmont soils which tested very low in phosphorus, an application of 40 pounds per acre of phosphoric acid gave increases in yield of 6.3 and 15.7 bushels per acre, respectively. There was no further response to a higher application of phosphoric acid.

On several Coastal Plain soils which tested medium to high in phosphorus, corn gave an early vegetative response, but no yield response to phosphoric acid applications.

Nitrogen Applications Increase Both Numbers and Size of Ears

Studies of ear size and number made at several locations indicated that as the nitrogen application was increased, the yield from single eared plants increased to about 40 bushels

per acre and then leveled off, the percentage of double eared plants increased throughout the range, and the ratio of weight of first ear to second ear of double eared plants was consistently about 2 to 1 throughout the range.

Improved Control of Earworms in Corn

The application of DDT added to mineral oil greatly improved the control of earworms in corn as shown by tests conducted during the summer of 1945. The use of a white petroleum oil for control of earworms on sweet corn has been known and practiced to some extent for a number of years. However, highly refined, odorless, medicinal grade oil is necessary to prevent the ears from acquiring a disagreeable flavor. Other materials have been added to increase the effectiveness of the oil for killing the worms.

The new insecticide DDT was tested for this purpose in comparison with two other materials previously used. Tests were conducted on hybrid seed corn but the results should also be applicable to sweet corn. The oil was applied by means of a textile oiler adjusted to give a uniform dosage of .75 cc per ear (one-fifth teaspoonful or about 25 drops). The percentage of ears with worms entering through the silks is shown in Table 1.

Clipping the silks to remove them with any eggs they contain has been recommended in some northern states as a control measure. Plots where this was practiced before applying the oil reduced slightly the percentage of earworms as compared to oiling alone as shown in the table. However, the extra operation almost doubled the amount of labor necessary for the treatment. It has been found that oiling with the correct dosage leaves almost no deposit of poison on the grain as the oil tends to follow along the strands of silk. Some practical experience is needed for the best application of this control measure.

TABLE 1.

Materials added to oil to make a 2 % solution in each case	Tip of husk and silks clipped off before oiling.	Per cent of wormy ears, average of 2 plots.
Dichlorethyl ether	No	54.5
Dichlorethyl ether	Yes	46.0
Styrene dibromide*	No	24.7
Styrene dibromide	Yes	18.2
DDT (technical grade)	No	8.3
DDT (technical grade)	Yes	3.2
Check, no treatment	No	96.6

* A commercial product.

COTTON

First Results on Lime and Fertilizer Tests in Cotton-Peanut Rotations

In some cotton-peanut rotations all the potash is applied to cotton, while in others part of it is applied to peanuts and part to cotton. To compare these and other treatments, experiments were started in 1945 at three locations in the peanut area to determine the proper time and rate of application of fertilizer materials and lime in this rotation. Both calcitic and dolomitic limestones are being used to determine the need for magnesium.

Results from the first year revealed that cotton yields were not increased by applications of calcitic limestone while dolomitic limestone produced higher yields of cotton at all three locations. The increases were not large, ranging from 120 to 168 pounds of seed cotton per acre.

Also, it was found that yields were just as large from 40 pounds of potash per acre as from higher rates. And at two locations 60 pounds of phosphoric acid per acre increased the yield of seed cotton 294 and 298 pounds per acre over the yield obtained with 20 pounds phosphoric acid.

Heavy Rainfall Reduces Fiber Strength

Twenty-three inches of rainfall were recorded at Rocky Mount from July 1 to Sept. 9, 1945, which was about twice the normal rainfall. As a result, cotton made a very large plant growth with exceedingly heavy foliage, and opened about a month later than usual. July 1944 had had about an average rainfall, August was dry, plant growth was about normal and the crop matured early. Even though the soil type and fertilization were the same for both years, the average fiber strength of 15 varieties and strains was only 76 per cent as strong in 1945 as in 1944. However, the staple length and fineness of fiber were about the same for both years. And while all the varieties produced better than a bale per acre during both years, yields were somewhat higher in 1944. But because of the lower fiber strength in 1945, mills will probably find that year's crop does not produce the strength of yarn desired for certain fabrics.

Defoliation at Right Time Does Not Reduce Fiber Strength

Aero Defoliant was used on the cotton breeding plats to remove the leaves, and thus prevent boll rot and hasten opening. Very few bolls had started opening when the dust was applied on Sept. 10, although many of the lower bolls were at least 50 days old and the top bolls which were not damaged by weevils were full grown. Samples of seed cotton were picked from 28 varieties and strains before the first picking was made and also before the second picking. The second picking represented about one-third of the total crop. No differences were found between the first and second pickings in fiber strength, fineness or staple length.

These results indicate that removal of the leaves does not injure the quality of the fiber, provided the fiber has reached its full development. Applying the dust too early will cause young bolls to dry up and open prematurely, resulting in loss in weight and very weak fiber.

Nitrogen and Potash Affect the Oil Content of Cottonseed

Applications of either nitrogen or potash produced good increases in yield of cotton grown on a Norfolk fine sandy loam at the Upper Coastal Plain Station. The seed from the various treatments were analyzed to determine if the oil content or the total production of oil was also affected.

The data in Figure 12 show that additions of potash increased the oil content of the seed about 3 per cent while additions of nitrogen had little effect. Since both nitrogen and potash increased the yields, however, the total amount of oil produced per acre (figures at top of bars) was markedly increased by both of these materials. With adequate nitrogen (60 pounds) the amount of oil was increased from 131 pounds per acre with no potash to 191 pounds with 60 pounds of K_2O (potash). With adequate potash (60

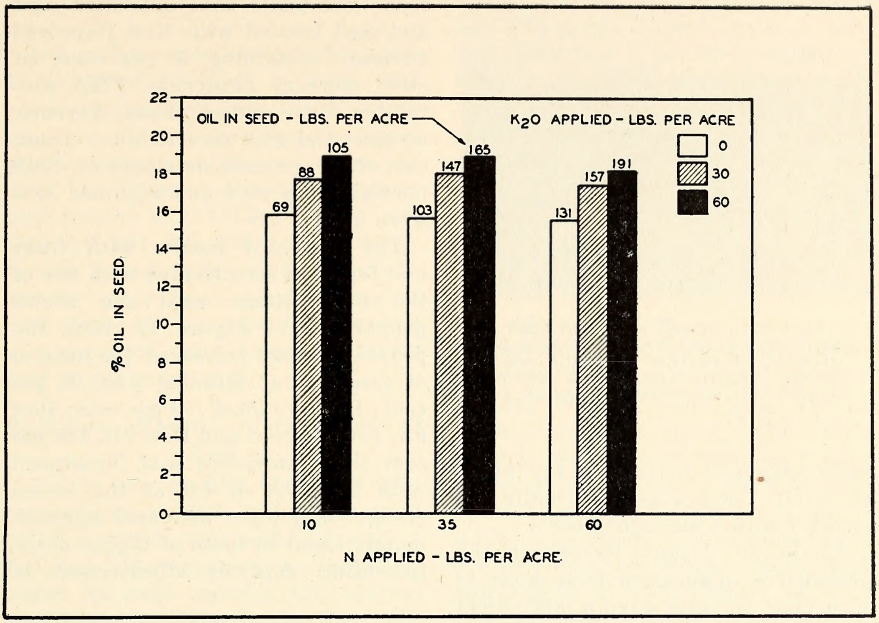


FIG. 12. EFFECTS OF NITROGEN AND POTASH ON OIL CONTENT OF COTTON SEED AND ON THE TOTAL AMOUNT OF OIL PRODUCED PER ACRE. FIGURES AT TOP OF BARS WERE OBTAINED BY MULTIPLYING THE PERCENTAGE OIL IN THE SEED BY THE TOTAL YIELD OF SEED IN POUNDS PER ACRE.

pounds) the amount of oil was increased from 105 pounds with 10 pounds of nitrogen to 191 pounds with 60 pounds of nitrogen.

Defoliation of Cotton Reduces the Number of Rotten Bolls

Under conditions of a heavy foliage development of cotton in 1945, dusting with 30 pounds per acre of Aero defoliant on September 11 reduced the rotting of bolls.

The defoliant caused the leaves to drop and bolls opened that otherwise would have rotted. The undusted cotton had twice as many rotten bolls as the dusted cotton. Another advantage of the treatment was that the cotton pickers were able to pick the cotton from the defoliated plots 10 per cent faster.

Influence of Fertilizers Upon Fiber Quality

Two experiments were set up in 1944 to determine the effects of nitrogen, phosphorus and potash upon lint and seed characteristics as well as on yield. One was located on Norfolk fine sandy loam at Rocky Mount, the other on Cecil gravelly loam at Wake Forest. The effects on lint characteristics for one year are as follows:

At Rocky Mount increasing the nitrogen application from 10 pounds per acre to 60 pounds produced a larger boll, a lower lint percentage, an increase in the percentage of thin-walled fibers from 14 to 24 per cent, a slightly weaker fiber strength, and a small X-ray angle. At Wake Forest an increase in the nitrogen application produced a larger boll, a lower lint

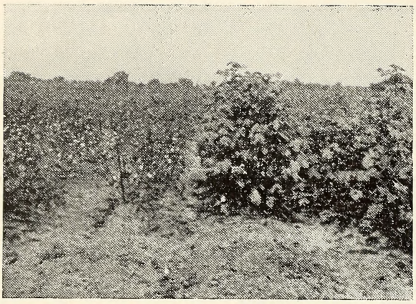


FIG. 13. ADDITIONS OF POTASH ON COTTON AFFECT THE LINT AND SEED CHARACTERISTICS AS WELL AS THE TOTAL YIELD. (LEFT, NO POTASH; RIGHT, 90 POUNDS PER ACRE.)

percentage and a small X-ray angle (a small X-ray angle is usually associated with a stronger fiber).

At Rocky Mount increasing the phosphorus application from none to 90 pounds per acre gave a large yield response (Fig. 13) and was associated with a larger boll, a heavier fiber, a larger X-ray angle and a weaker yarn strength. At Wake Forest the increase in yield from added potash was not as great but was related to a large X-ray angle, and a weaker fiber.

New Materials Superior for Seed Treatment

Two relatively new seed treatment preparations, DuBay 1452-F, containing 7.7 per cent of ethyl mercury p-toluene sulfonanilide, and Dow 9, containing approximately 100 per cent of zinc 2, 4, 5-trichlorophenate, both of which gave good results on cotton seed in field trials in 1944 tested again in 1945.

Modifications of Dow 9 designated 9A having 25 per cent and 9B having 50 per cent of 2, 4, 5-trichlorophenate were used in 1945. Each chemical in the test was used at dosages of three-fourths, one and one-half, and three ounces per bushel of seed. Comparisons were made with untreated seed and seed treated with New Improved Ceresan containing 5 per cent of ethyl mercury phosphate, PMA containing 5 per cent of phenyl mercuric acetate, and with several other chemicals of more recent development. Both normal fuzzy seed and reginned seed were used.

The combined results with fuzzy and reginned seed treated with five of the preparations used are shown graphically in Figure 14. New Improved Ceresan increased the number of seedlings at thinning time 90 per cent; DuBay 1452-F, 93 per cent; Dow 9A, 125 per cent and Dow 9B, 130 per cent above untreated seed. Treatment with Dow 9A or 9B at the lowest dosage used gave increases approximately equal to those of higher doses, indicating superior effectiveness of

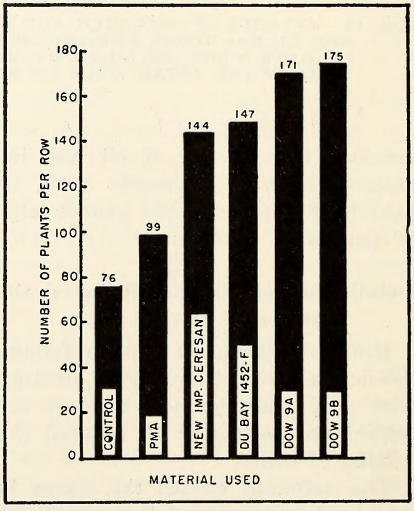


FIG. 14. NUMBER OF COTTON PLANTS AT THINNING TIME FROM UNTREATED (CONTROL) SEED AND FROM SEED TREATED WITH FIVE DIFFERENT SEED TREATMENT PREPARATIONS. FOUR HUNDRED SEEDS WERE PLANTED IN 50-FOOT ROWS. EACH COLUMN FOR TREATED SEED IS THE AVERAGE OF 24 ROWS (12 PLANTED TO FUZZY SEED AND 12 TO REGINNED SEED) AND THE TOTALS ARE AVERAGES FOR THE THREE DOSAGE RATES.

this material for cotton seed treatment.

In another experiment DuBay 1452-F and Dow 9B used to treat seed seven days and 42 days before planting gave higher seedling increases than Ceresan treated seed under the same conditions. Emergence from seed treated with DuBay 1452-F and Dow 9B did not differ significantly for the 7- and 42-day storage periods. On the other hand, Ceresan treated seed stored 42 days gave less increase in emergence than Ceresan treated seed stored seven days.

Reginning Hastens Germination of Seed

A test run in 1945 confirmed field observations in that cotton seed from which a considerable part of the short lint has been removed by reginning comes up more rapidly and reaches a stand a few days earlier than normal fuzzy seed.

In this test seed of Coker 100 variety having 14 per cent of short lint was used. The seed was divided into three lots. Two lots (designated R1 and R3) were run through a delinter gin set to remove different amounts of short lint. From R1, 179 pounds of lint per ton of seed were removed, and from R3, 243 pounds, leaving 5 per cent and 1.8 per cent of lint on the respective lots. The third lot (F) was planted without reginning. All lots were treated with Ceresan before planting.

Three plantings were made (planting 1 on May 8, planting 2 on May 19, and planting 3 on June 12) in sandy loam soil at the McCullers Branch Experiment Station Farm. Seedling counts were taken at frequent intervals during the period of seedling emergence The relative emergence of the three lots at each date of planting is shown in Figure 15.

At all dates of planting the lot with the least short lint (R3) came up most rapidly while the seed of lot F having

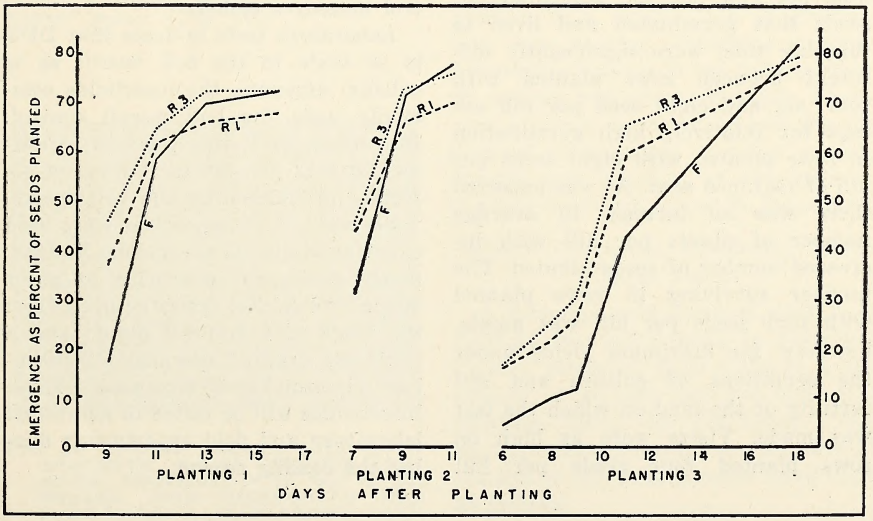


FIG. 15. EMERGENCE OF REGINNED AND FUZZY COTTON SEED IN THREE PLANTINGS AT McCULLERS. F, NORMAL FUZZY SEED CARRYING 280 POUNDS; R1, REGINNED SEED CARRYING 101 POUNDS; R3, REGINNED SEED CARRYING 37 POUNDS OF SHORT LINT PER TON.

the most lint came most slowly. The lot (R1) with the intermediate amount of lint was intermediate in time of emergence. The final emergence from the fuzzy seed equaled or slightly exceeded that from the reginned seed.

Why Plant More Seeds When Less Will Do?

To determine what might be an adequate seeding rate for cotton, four, six, and eight seeds treated with Ceresan were planted per hill in a test plot. These seeding rates are equivalent to approximately 13, 19.5 and 26 pounds of fuzzy seed per acre. The hills were spaced 12 inches apart in rows of 50 hills each. Plantings were made on two dates—April 27 and May 11—at the Upper Coastal Plain Branch Station. At the usual time for thinning, counts were made of the number of hills and number of living plants and at the end of the season yield records were taken.

Neither the percentage of surviving hills per row nor the percentage of seeds that germinated and lived to thinning time were significantly different between rows planted with four, six and eight seed per hill except for relatively high germination in rows planted with eight seeds per hill of reginned seed. As was expected there was an increase in average number of plants per hill with increased number of seeds planted. The number surviving in rows planted with four seeds per hill was ample, however, for maximum yields under the conditions of culture and soil fertility of the land on which the test was made. Yields were as high on rows planted four seeds per hill as on rows planted six and eight seeds per hill.

Thinning gave no significant increases in yields over unthinned rows with either fuzzy or reginned seed at either date of planting.

The results of this experiment planted in 1945 agree with those of similar tests planted at the same location in 1943 and 1944. In these three years the extra seeds planted above four or five per hill were wasted and the labor required for thinning the more heavily seeded rows gave doubtful returns.

DDT Doubtful for Control of Cotton Insects

Cotton in the central and southern cotton growing districts of the state was heavily infested with the cotton boll weevil during the 1945 season. Warm, humid weather seemed to have some connection with this abundance of the weevil. Under those conditions and because of the frequent rains, it was difficult to determine the effectiveness of different chemical control measures tested.

Laboratory tests indicate that DDT is as toxic to the boll weevil as is calcium arsenate, the insecticide commonly used for boll weevil control. But when DDT was tried in experimental field plot trials, it was not effective in controlling the boll weevil.

Several other insecticides were used experimentally. These include Ryanex, newly developed insecticide of plant origin; Sabadilla, manufactured from the seeds of a tropical plant; and a synthetic organic compound containing piperonyl-cyclo-hexanone. These insecticides will be tested in additional laboratory and field experiments during the coming season.

PASTURES AND FORAGE

Ladino Clover Is Good in Mixture

In a permanent pasture experiment on an upland soil in the lower Piedmont during 1945, Ladino clover was slightly more productive than white clover and much more productive than subterranean and low hop clover or Kobe lespedeza.

Excellent stands were established in the fall of 1944 and mixtures of both white clovers with either Dallis or orchard grass produced between 4,000 and 5,000 pounds of dry matter per acre. The winter annuals, subterranean and low hop clover, are seemingly slower in becoming established. Combinations of lespedeza with either Dallis or Coastal Bermuda grass produced approximately 3,000 pounds per acre. This legume serves two purposes in a permanent pasture, it provides grazing during the midsummer when clover is not productive and is a precautionary measure to assure the presence of a legume during "off-clover" years. (Fig. 16)

FIG. 16. LADINO CLOVER WILL GROW WHEREVER WHITE CLOVER WILL GROW, PROVIDED IT IS NOT OVER-GRAZED. THIS PHOTOGRAPH WAS MADE MARCH 2, 1945, FROM A SEEDING MADE THE PREVIOUS SEPTEMBER. THIS DALLIS GRASS—LADINO CLOVER MIXTURE PRODUCED THE EQUIVALENT OF 53 GRAZING DAYS PER ACRE BY THE END OF APRIL.

Management Important for Pastures

The detrimental effects of close grazing were reflected in a management study during the past summer. By clipping the sod every 15 days, only 3,418 pounds of forage were harvested, whereas 4,649 pounds were produced where the plots were harvested at 30-day intervals.

In another series of plots in the same experiment in which early clipping was avoided, 2,885 pounds of forage were harvested May 19 and a total of 4,745 pounds produced for the entire season — the harvests being made to simulate grazing for the remainder of the season. Another plot was harvested at the end of March and then allowed to grow a one and one-half ton crop of hay between that date and May 30. The total production for the growing season was 4,732 pounds of dry forage.

Thus it appears that a good grass-legume mixture may be used for grazing or a combination of grazing and hay making. Omitting certain harvesting periods in the fall resulted in serious reductions in yield. These sods are only one-year-old and the effect of management systems on the growth and survival of the various pasture crops cannot yet be measured.

Alfalfa Continues Promising After Three Years

A three-year-old stand of alfalfa on Norfolk fine sandy loam in Johnston County produced from 6,420 to 6,800 pounds of air dry hay per acre, depending upon the treatment. The average yields from all treatments for the life of the alfalfa stand have been as follows:

1943 — 5,019
1944 — 7,393
1945 — 6,614

There was still an excellent stand at the end of the third year and no reason to doubt but that the fourth year would produce equally as well.

Southern Types Alfalfa Not For Mountains

The first year's results on a comparison of 10 varieties of alfalfa indicated that Southern types as Arizona, Chilean and Argentine cannot tolerate the low temperatures of the Mountains. The adaptation of these varieties is being studied further, but, in the meantime, it would be a safer procedure to plant only varieties that are known to be suited.

Such varieties as Kansas and Oklahoma Common are known to be adapted. Several of these varieties produced more than three tons of hay from a first-year crop on a soil of medium productivity in the Lower Piedmont.

Grow Your Own Nitrogen

Grasses need nitrogen for maximum production, but a good legume population will provide it more effectively and economically than will commercial nitrogen.

In previous experiments 16, 32, and 48 pounds of elemental nitrogen (Equivalent to 100, 200, and 300 pounds of nitrate of soda, respectively) were used on grass-legume mixtures and the returns from nitrogen were relatively small.

During 1945 seven rates of nitrogen were used on grass-legume mixtures

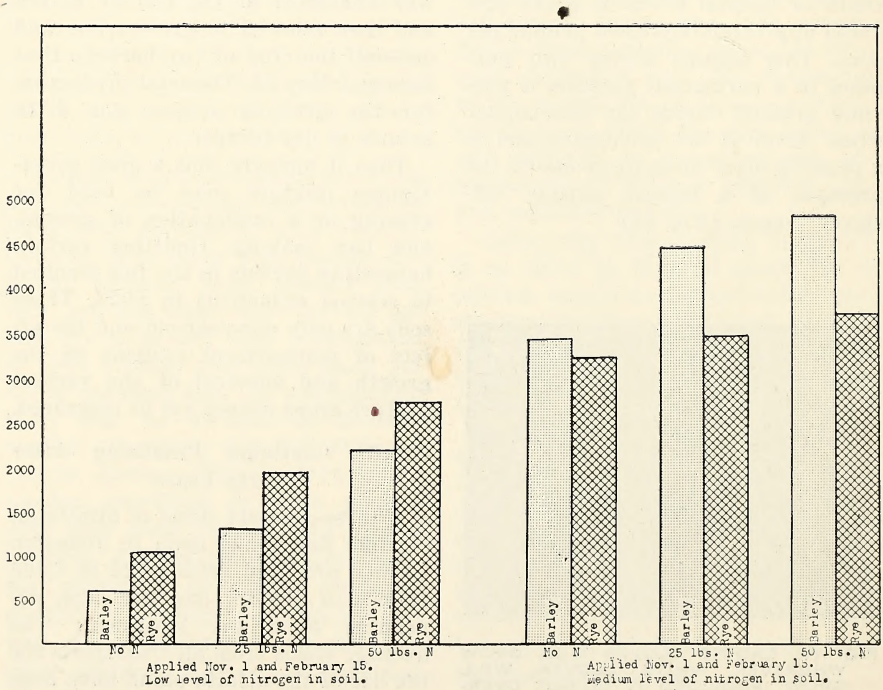


FIG. 17. BARLEY IS NOT ADAPTED TO UNPRODUCTIVE SOILS. IT DID RESPOND TO HEAVY NITROGEN FERTILIZATION AND PRODUCED NEARLY 5,000 POUNDS OF DRY MATTER BETWEEN NOVEMBER 1 AND MAY 11. RYE IS ADAPTED TO SOILS TOO DEFICIENT IN NITROGEN FOR BARLEY. SUCH LAND CAN BE SEEDED TO RYE FOR WINTER GRAZING PROVIDED IT IS LIBERALLY FERTILIZED WITH NITROGEN.

with the treatments varying from none up to 200 pounds of nitrogen per acre. The results may be briefly summarized as follows:

Nitrogen treatment	Yield of grass-legume
None	4,129
100 lbs.	4,365
200 lbs.	4,385

In all cases adequate quantities of limestone, phosphate and potash were applied and good stands of legumes were obtained. It is clearly indicated that the equivalent of either 600 pounds or 1,200 pounds of nitrate of soda is not economical when applied to a sod containing a satisfactory stand of legumes. The only practical advantage of nitrogen in this experiment was in stimulating growth in the early spring but this increase would not justify the expense of the commercial nitrogen.

Small Grains Respond to Nitrogen

The amount of winter grazing that one can expect depends upon the grain used, amount of nitrogen fertilization used, and time of seeding the grain. For example, barley produced more winter forage than did rye on land that contained a medium nitrogen level, but it made much less growth than did rye on a sandy soil that was low in nitrogen. Both grains responded markedly to nitrogen added to the soil that was low in nitrogen, but rye was much less responsive on the more productive soil. These results are shown in Figure 17.

Expensive Not to Fertilize Pastures

Investments in phosphate, potash, and limestone paid big dividends on Dallis grass-Ladino clover during 1945 at the Coastal Plain Station. Each dollar invested in phosphate, potash, and limestone returned nine dollars worth of forage. Omitting limestone from the treatment resulted in a reduction of approximately 2,300 pounds

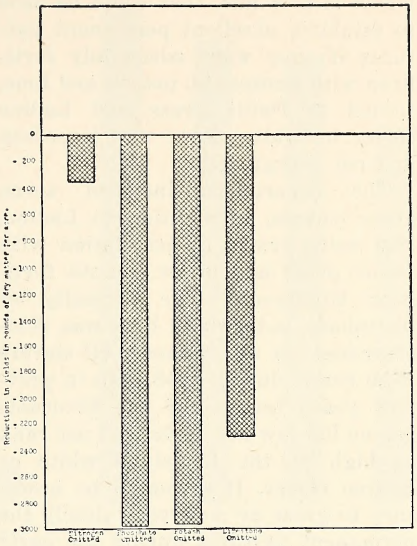


FIG. 18. IT IS EXPENSIVE NOT TO FERTILIZE A PERMANENT PASTURE. OMITTING EITHER PHOSPHATE, POTASH OR LIMESTONE RESULTED IN GREAT REDUCTIONS IN THE YIELD OR CARRYING CAPACITY OF A DALLIS GRASS-LADINO CLOVER PASTURE IN 1945. EACH DOLLAR INVESTED IN THESE THREE MATERIALS RETURNED NINE DOLLARS IN GRAZING VALUES. BASIC TREATMENT WAS NITROGEN, PHOSPHATE, POTASH, AND LIMESTONE. THE OMISSION OF EITHER OF THESE FROM THE TREATMENT RESULTED IN YIELDS AS INDICATED.

of dry matter per acre. (Fig. 18) A loss of 2,971 pounds was suffered by omitting potash from the pasture treatment, and where the sod received everything needed except phosphate the yield was 2,987 pounds less than where the phosphate was included.

These returns were obtained from an established stand of Dallis grass and Ladino clover and during a year that was favorable for the clover. During other years the increases have not been as great but they have always paid large dividends. This particular soil was a poorly drained "crayfish" soil and one that is not suited to cultivated crops. There are thousands of acres of such land in Eastern North Carolina, much of

which is now idle, that could be used to establish excellent permanent pastures if they were adequately fertilized with phosphate, potash and lime, seeded to Dallis grass and Ladino clover or white clover and lespedeza and not overgrazed.

The experiment included seven other clovers, in addition to Ladino, that were grown in association with Dallis grass and under the six fertilizer treatments. The necessity of phosphate, potash and lime was demonstrated for all of them. All clovers were better during 1945 than in previous years because of the favorable season but low hop clover did not rank as high as the Louisiana white or Ladino clover. It seems to be necessary to graze or mow very closely the permanent pastures during the early fall if low hop is to maintain itself in the soil. The combination of a high rainfall during the fall of 1944 and a high mean temperature for March resulted in an unusually good performance of the subterranean clover. This was the first time during the five years the experiment has been in progress that the subterranean clover seedlings germinated in August and continued to grow throughout the fall, winter and spring.

Earlier experiments at this location had indicated greater needs for potash than had been experienced on many other soils. The second year's results from a rate of potash study gave a response as follows:

100 lbs. muriate of potash every 2 years—5,220 lbs. dry matter per acre;
200 lbs. muriate of potash every 2 years—5,423 lbs. dry matter per acre;
400 lbs. muriate of potash every 2 years—5,728 lbs. dry matter per acre;
600 lbs. muriate of potash every 2 years—6,219 lbs. dry matter per acre.

All plots were adequately fertilized with phosphate and limestone and had a good stand of Dallis grass and legumes. The heaviest rate of 600 pounds every two years resulted in an increase of one half ton of excellent forage.

PEANUTS AND SOYBEANS

Peanuts on Sandier Soils Require More Calcium

In tests run on the sandier soils, which contain relatively little clay and where organic matter is responsible for most of the calcium-retaining properties of the soil, more calcium need be added to give good peanut production, than on soils that contain more clay—and which contain sufficient mineral colloid to act as the calcium-retaining medium.

Investigations with peanuts were continued this year in outdoor frames so constructed that the peanut roots are separated from the area in which the peanut fruit forms and the two areas can be treated separately. Making use of these frames, comparisons were made of the levels of calcium necessary for production of good-quality nuts when different colloids made up the area in which the peanuts were formed. Previous work had shown that when peanuts are grown in a colloid that is entirely organic (muck), the calcium requirement is higher than if peanuts form in a mineral colloid (kaolin).

This year, mixtures of various amounts of organic and mineral colloids were prepared so as to have different levels of calcium saturation. Peanuts were grown so that the fruit formed in these different colloid mixtures. The results of this study are shown in Figure 19.

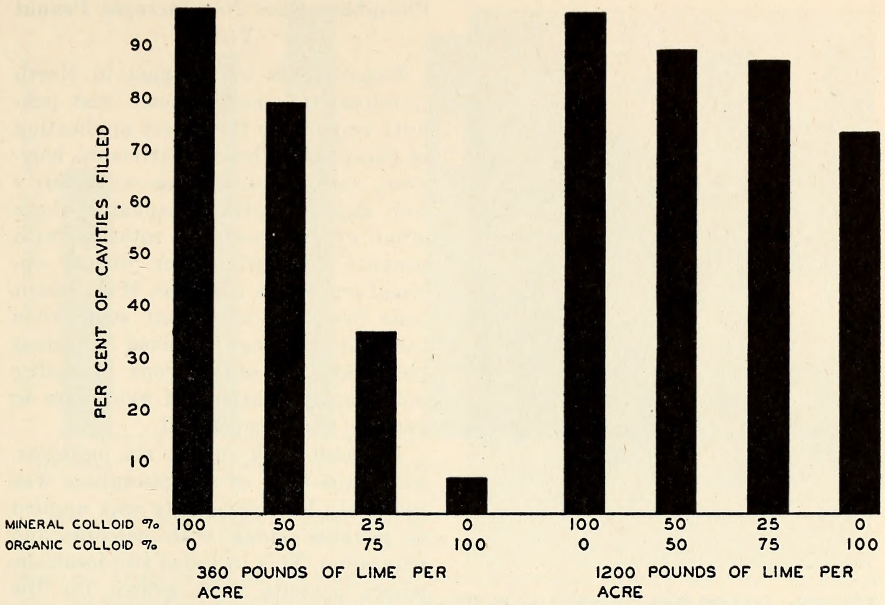


FIG. 19. THE CALCIUM REQUIREMENT OF PEANUTS IS HIGHER WHEN THE SOIL CONTAINS MORE ORGANIC MATTER. WHEN THE SOIL CONTAINS MORE MINERAL CLAY, GOOD PEANUTS ARE PRODUCED AT THE LOW AND MEDIUM LEVELS OF CALCIUM. BUT WHEN THE MINERAL CLAY MATTER IS LESS AND THE ORGANIC MATTER HIGHER, MORE CALCIUM IS NECESSARY FOR GOOD PEANUT PRODUCTION.

Means of Supplying Calcium for Peanuts

It has been shown in previous years that the proper amount of calcium is very important in peanut production. There must be sufficient calcium in the "pegging zone" (the area where the peanuts form) or poor-quality peanuts, which contain many pops, will be produced. (Fig. 20)

The farmer ordinarily furnishes this calcium by applying landplaster on the foliage of peanuts at early blooming time. This year, at six locations in the peanut area, experiments were started to study other means and time of supplying calcium. These included broadcasting ground limestone early in February at rates of 1,200 and 2,400 pounds per acre; applying ground limestone in the row at planting and on top of the row after the peanuts came through the ground; and finally, applying gypsum on the top of the row and on the foliage at blooming time.

Responses varied, depending on the calcium level of the soil and the type of soil. Where the lime level of the soil was lower than 0.90 M. E. (900 pounds of limestone per acre), there was always a heavier, greener growth of plant where lime had been broadcast. This is illustrated in Figure 21, which shows the heavier growth in the limed area. This increased growth resulted in an increased yield of peanuts, however, only when the original level of calcium in the soil was less than 0.40 M. E. (400 pounds of ground limestone per acre). Under some conditions, the yields were increased to about the same level with plaster, but this was not always the case. This is illustrated in Figure 22.

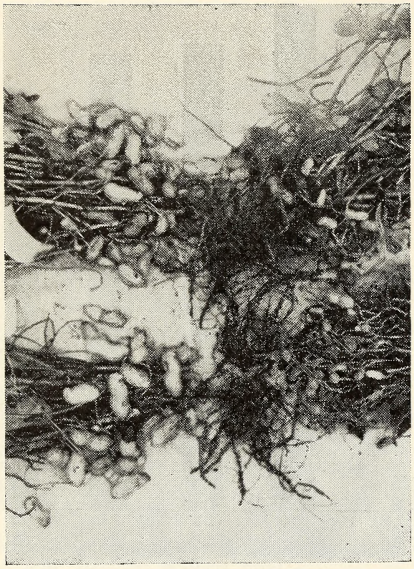


FIG. 20. IF THE SOIL IS VERY LOW IN CALCIUM, PEANUTS PRODUCE GREEN HEALTHY PLANTS BUT FEW QUALITY NUTS. THE PLANTS ON THE RIGHT RECEIVED NO CALCIUM, THOSE ON THE LEFT, SUFFICIENT CALCIUM.

Phosphate Does Not Increase Peanut Yields

Experiments in the past in North Carolina have never shown that peanuts respond to the direct application of phosphate. These experiments, however, were conducted on soils fairly well supplied with phosphate, where other crops grown in rotation with peanuts received rather liberal applications of the material. More recent tests have indicated that even when the soil has not received sufficient phosphate for other crops preceding peanuts, applications of phosphate to peanuts is uneconomical.

In these tests run at six locations, where the level of soil phosphate was relatively low, phosphate was applied to peanuts along with calcium and potassium. This included two locations where peanuts were grown for the second consecutive year. In no case was the yield increased by a phosphate application.

FIG. 21. ON MANY SOILS MODERATELY LOW IN CALCIUM BROADCASTING LIMESTONE WELL AHEAD OF PLANTING RESULTS IN A BIGGER, GREENER PLANT. ONLY WHERE THE SOIL IS EXTREMELY LOW IN CALCIUM DOES THIS RESULT IN A BIG DIFFERENCE IN YIELD. THE STACK ON THE LEFT CAME FROM A LIMED PLOT, THAT ON THE RIGHT FROM A PLOT RECEIVING PLASTER. BOTH PRODUCED ABOUT THE SAME YIELD OF PEANUTS.

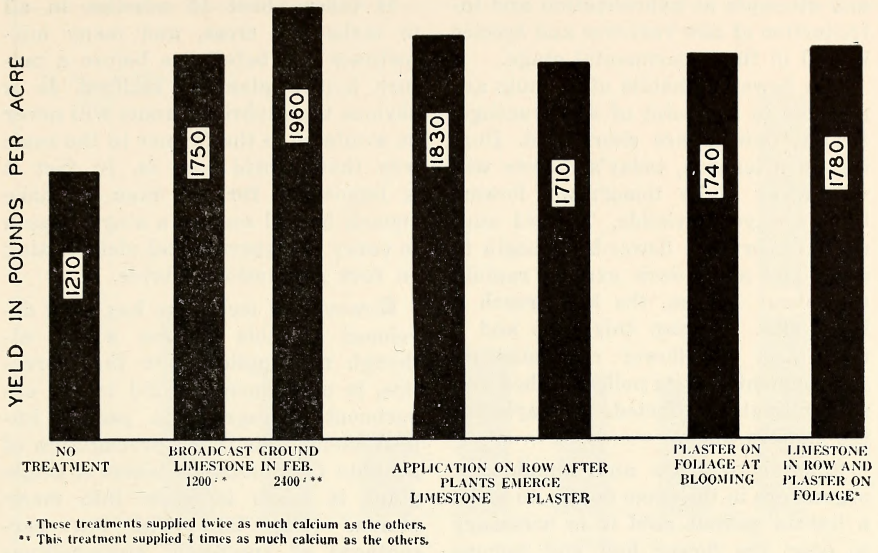


FIG. 22. THE AVERAGE OF TESTS AT SIX LOCATIONS INDICATES THAT CALCIUM NEEDS FOR PEANUTS CAN BE SUPPLIED BY EARLY BROADCAST APPLICATIONS OF GROUND LIMESTONE, AS WELL AS BY OTHER MEANS.

Peanuts Respond to Winter Cover Crops

Experiments conducted on a Norfolk fine sandy loam soil at Rocky Mount (Edgecombe County) showed that in a cotton-peanut rotation, peanut yields may be increased with winter cover crops.

This is the fourth year that this experiment has been under way and in none of the previous years has there been an increase in yield of peanuts due to the winter cover crops. This year, however, yields were increased on the average by about 40 pounds per acre.

Italian rye grass was equally as effective as vetch, Austrian winter peas, or crimson clover in increasing yields. In this same experiment, applications of 60 pounds of nitrogen per acre were not effective in increasing yields. The soil on which this experiment is being conducted is subject to compaction and is in generally poor physical condition. This year's growth of winter legumes was unusually heavy, amounting to as much as 6,000 pounds of dry matter per acre. The prolonged dry spell immediately after turning under the cover crops slowed up their decomposition and necessitated replanting peanuts on some of these plots. In spite of this, the yield increases were appreciable.

Peanut Improvement Through Breeding

The construction of the peanut flower is such that the formation of seed results almost entirely from self-pollination. Thus, only a limited number of pure breeding lines have been produced within which effective selection has been impossible. Coupled with this has been the relatively few sources of seed, which further limits the powers of selection. Therefore, peanut breeding work has been slow

and attempts at hybridization and introduction of new varieties and species is still in the experimental stage.

The flowering habits of peanuts are peculiar to the point of disadvantage. Peanut flowers are short-lived. During an afternoon, today's flowers will wilt away while tomorrow's flower-buds are yet invisible. Toward sundown tomorrow's flower-buds begin to grow and after dark expand rapidly and about 10 p.m. the buds reach a large size. Between this time and 3 to 5 a.m. the flower completes its development and its pollen is shed and self-pollination effected. At daybreak the flowers open.

Since both male and female sex organs are in the same flower, to make a hybrid peanut seed it is necessary to open the flower bud and remove the male flower parts (anthers) before the pollen is shed. To prevent self-pollination, the anthers must be removed between 10 p.m. and 3 a.m. Cross-pollination must take place before noon the following day.

It takes about 15 minutes in all to make one cross, and many misfortunes can befall one before a mature hybrid plant is realized. It is obvious that hybrid peanuts will never be available to the farmer in the same way that hybrid corn is. In fact it is impossible for one man to make enough hybrid seed in a single season to carry on experimental yield testing on first generation hybrids.

However, a technique has been developed by this Station which, although not applicable to farm practice, is of tremendous aid to the experimental program in peanut improvement. This is the propagation of peanuts from cuttings where a single plant is made to grow into many plants. (Fig. 23.) The low percentages of successful cross-pollination, of pods set, of seeds harvested, of seeds germinated, of plants obtained from seed, and the very large number of plants obtainable from cuttings are shown in Figure 24. From the figure it can be seen that by means

FIG. 23. ROOTING PEANUT CUTTINGS: UNTREATED CUTTING (LEFT), CUTTING TREATED WITH ROOT-INDUCING HORMONES (CENTER), ROOTED CUTTING (RIGHT).

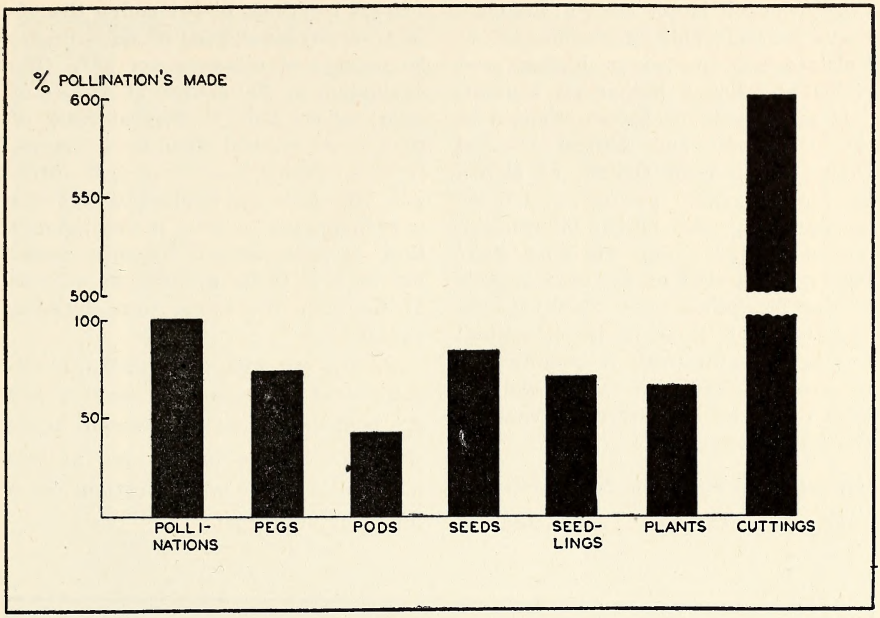


FIG. 24. GRAPH SHOWING RESULTS OF PEANUT HYBRIDIZATION IN COMPARATIVE RETURNS IN EXPERIMENTAL MATERIALS IN PERCENTAGE; BASED ON TOTAL CROSS-POLLINATIONS EQUAL 100.

of cuttings last year the number of hybrid plants available for experimental purposes was increased over 600 per cent of the original hybrid pollinations.

By means of the cutting technique in 1945 this Station probably conducted the first F_1 (first generation) hybrid peanut test in the history of peanut breeding. First generation hybrid testing gives a relative measure of the amount of improvement that might be expected from a hybrid combination. Figure 25 shows the effect on yield of crossing a commonly grown N. C. variety with a large low yielding Runner from Argentina.

Through the cooperation of the Office of Plant Exploration and Introduction, Bureau of Plant Industry, USDA, North Carolina last year received varieties and species of peanuts from Brazil, Argentina, Paraguay, Uruguay, Iran, Egypt, Belgian Congo, Rhodesia, S. A. Ugandi, Costa Rica, Kalama, Mauritius, Java, and India. These introductions include cultivated as well as wild peanuts. They form the basis for a second source of heritable variability and selection for the improvement of North Carolina peanuts.

Roanoke, a New Soybean

Roanoke, a new variety of soybean developed by the Agricultural Experiment Station, is well adapted to North Carolina conditions. In addition to giving excellent yields, Roanoke has an oil content superior to any other variety adapted to this state.

The Roanoke soybean is well suited to the Coastal Plains and Piedmont areas of North Carolina. Because of its higher yielding capacity (Figs. 26 and 27), greater resistance to shattering, and higher oil content, it might well replace Woods Yellow in all

areas where it is now grown. Roanoke bears considerable resemblance to Volstate but has given higher seed yields and has a higher oil content.

It appears to be better adapted to the Piedmont and Upper Coastal Plains areas than Ogden, as shown by higher yields, greater resistance to shattering, and higher oil content. Yields of these two varieties have been quite similar on the heavier soils of the Tidewater area. However, the superiority of Roanoke in oil content has been maintained. A combination of the two varieties might well be used to extend the harvest period for the large grower.

Nitrogen on Soybeans Not Profitable

Experiments were conducted at several locations to determine the effects on soybean yields of sidedressing 50 pounds of nitrogen per acre (the equivalent of 300 pounds of nitrate of soda) about July 1. Several rates of lime were applied also to determine if lime affected the response to nitrogen. Nitrogen was applied to soybeans experimentally because it was thought that soybean nodule bacteria might not be able to fix a sufficient amount at the time the beans were forming rapidly.

On one soil with a pH of 4.2, applications of nitrogen increased yields 3.3 bushels per acre. However, there was no response to nitrogen at this location or at the other locations when lime was broadcast.

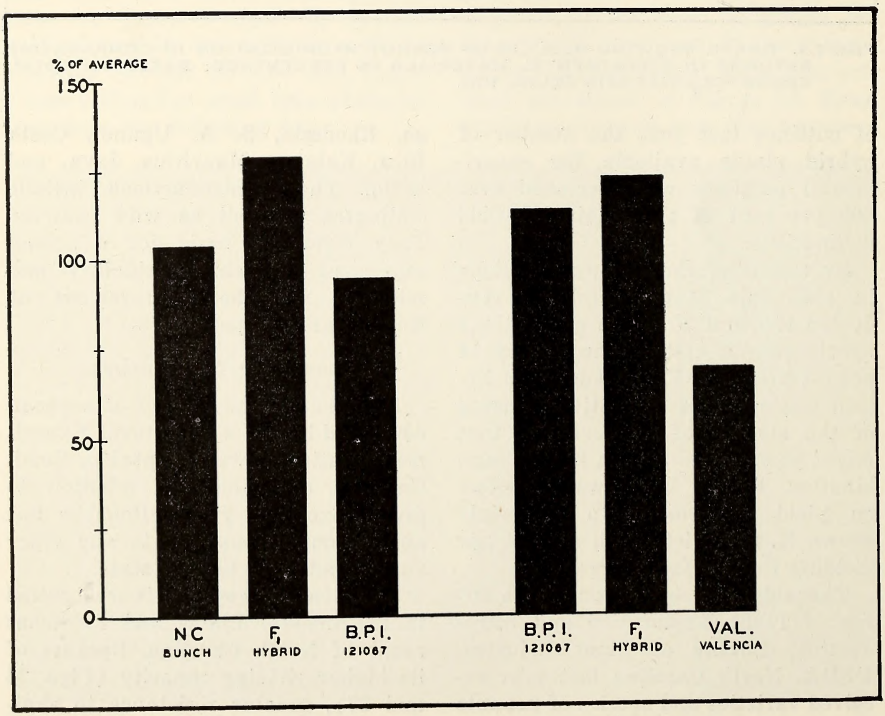


FIG. 25. HYBRID VIGOR IN TWO PEANUT CROSSES—TWO PARENTS AND THE CROSS BETWEEN THEM. DRY WT. OF NUTS (LEFT) TOTAL GREEN WT. (RIGHT).

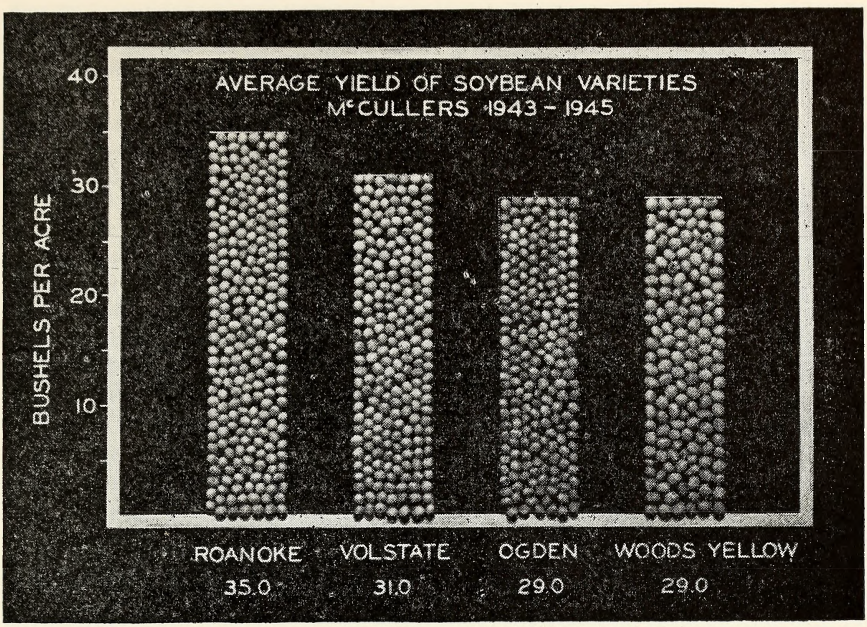

AVERAGE YIELD OF SOYBEAN VARIETIES
McCULLERS 1943 - 1945
BUSHELS PER ACRE
40
30
20
10
ROANOKE
35.0
VOLSTATE
31.0
OGDEN
29.0
WOODS YELLOW
29.0

FIG. 26.

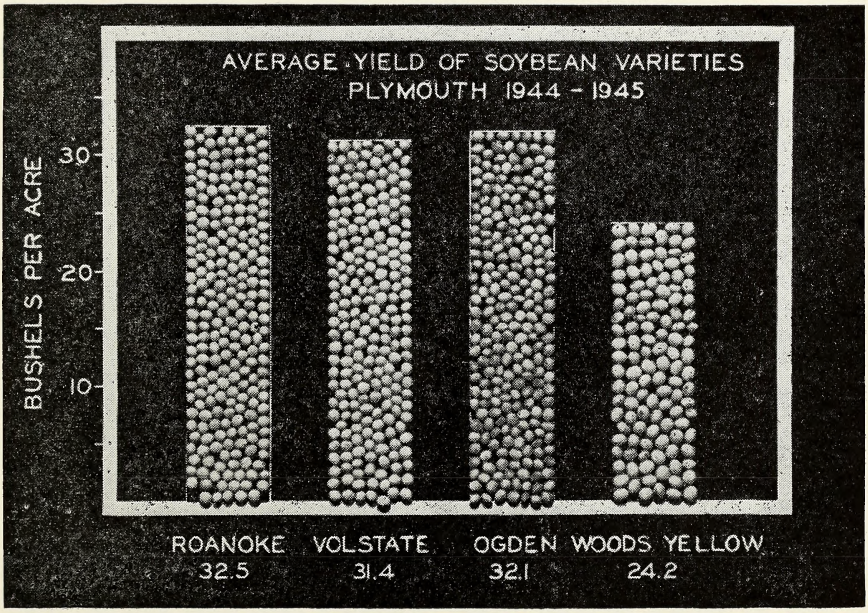

AVERAGE YIELD OF SOYBEAN VARIETIES
PLYMOUTH 1944 - 1945
BUSHELS PER ACRE
30
20
10
ROANOKE
32.5
VOLSTATE
31.4
OGDEN
32.1
WOODS YELLOW
24.2

FIG. 27.

Effect of Potassium and Magnesium On Pod Formation and On Seed Characteristics

Pod formation and seed characteristics of soybeans were studied under conditions of a marked yield response to potassium and magnesium. While it is known that applications of these elements increase yields, it is not known what components of yield are affected. For example, it may be by increasing the number or the retention of pods to maturity, the size of the pods, their degree of filling, or the seed size.

It was found that additions of potash increased the number of pods formed per plant. Moreover, with no potash 57 per cent of the pods were dropped after September 5 while with adequate potash only 41 per cent were dropped.

The effect of magnesium was not marked. The nutrients had little effect on pod size but potash had a very great effect on the amount of filling of the pods. With no potash only 60 per cent of the cavities were filled while with adequate potash 79 per cent were filled. Potassium increased seed size about 28 per cent and decreased the poor quality beans from 37 per cent without potash to 3 per cent with adequate potash. It was found that additions of either potassium or magnesium retarded maturity as measured by the moisture content of the beans.

Soybeans Need Lime

A series of experiments were begun on several soil types in 1945 to study the relationship between soil properties and lime for soybeans. Three rates of calcitic limestone and three

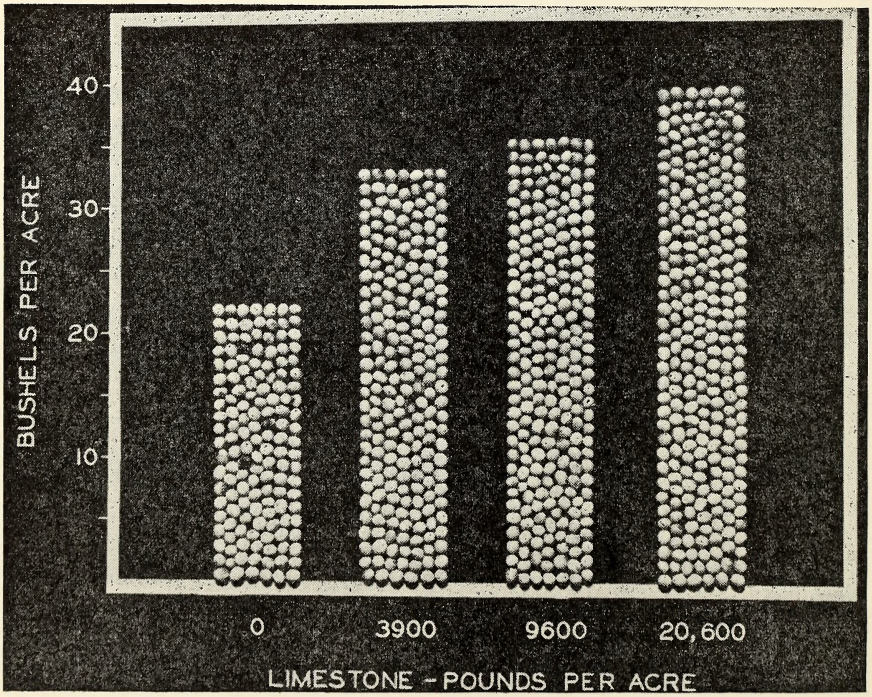


FIG. 28. APPLICATIONS OF LIMESTONE ON PORTSMOUTH SANDY LOAM (PH 4.2) INCREASED THE YIELD OF SOYBEANS 17 BUSHELS PER ACRE.

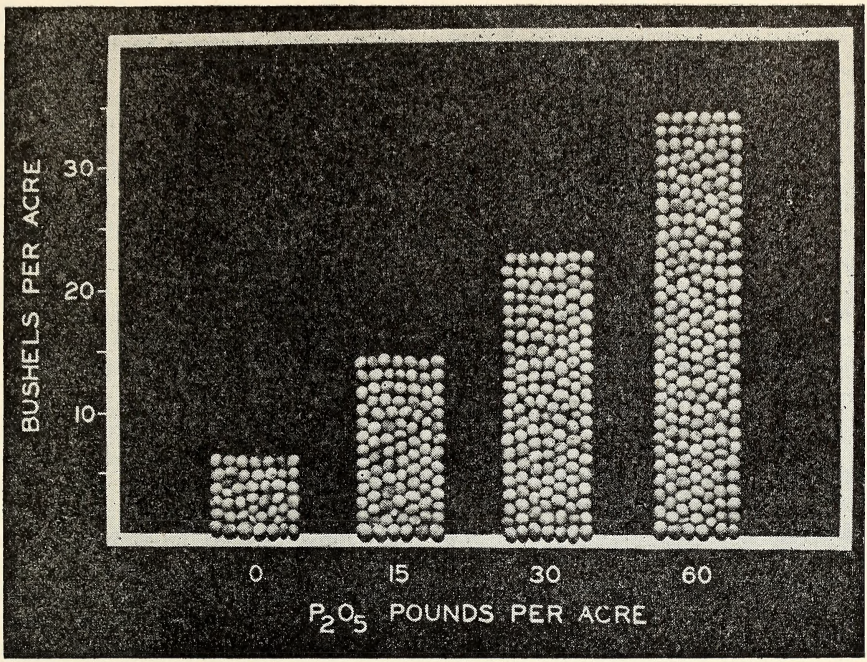


FIG. 29. RESPONSE OF SOYBEANS TO PHOSPHATE ON A SOIL VERY LOW IN SOLUBLE PHOSPHORIC ACID (P_2O_5), 32 POUNDS PER ACRE (60 POUNDS OF P_2O_5 IS EQUIVALENT TO 300 POUNDS OF 20 PER CENT SUPERPHOSPHATE).

rates of dolomitic limestone were compared to no lime. It is planned to carry on these experiments for two more years to obtain the representative effects of the lime.

Results from one year, however, show increased yields from the lime applications at all locations. There were no differences in the response to calcitic and dolomitic lime. Figure 28 shows graphically the response on a Portsmouth sandy loam in Pamlico County. Yields were increased from 22 bushels with no lime to 39 bushels with the highest rate of lime. This soil has a very high lime requirement. In most of the dark, poorly drained soils, however, increasing the pH above 5.8-6.0 will cause manganese deficiency.

Some Soybean Soils Need Phosphate

Certain soybean soils produce increased yields of soybeans when phosphate is placed in the row at planting. In general, the size of the response is related to the amount of soluble phosphoric acid in the soil already.

The response of soybeans to applied phosphate on a soil very low in soluble phosphoric acid, 32 pounds per acre, is shown in Figure 29. Increases in yield of 3.5 and 3.1 bushels were obtained from the application of 40 pounds of phosphoric acid on soils containing 50 and 78 pounds, respectively. Very little response can be expected on soils containing more than 150 pounds of soluble phosphoric acid.

Copper Dusts Control Bacterial Pustule

Only dusts containing copper reduced bacterial pustule in tests on soybeans during 1945. By the middle

of the summer an observer could readily pick out the rows treated with copper dusts by the better appearance resulting from greater freedom from disease.

The dust preparations used were: (1) copper-clay containing 7 per cent metallic copper from Tenn. 34, (2) copper-talc containing 7 per cent copper from copper compound A, (3) 20 per cent fermate in talc (Pyrox), (4) 20 per cent zerlate in talc (Pyrox), (5) 325-mesh sulphur, (6) 10 per cent fermate in sulphur, (7) 5 per cent DDT in sulphur. Six applications of each dust were made.

On control rows not dusted, less than 5 per cent of leaves were entirely free of disease while the remaining 95 per cent showed damage ranging from slight to severe. On rows dusted with copper 37 to 74 per cent of the leaves were entirely free of disease while the remaining leaves showed little injury, few or none being severely damaged.

Plots dusted with copper yielded 4.9 bushels per acre more than undusted plots. Sulphur dust reduced yields about as much as copper increased them.

The 1945 season was marked by frequent rains at the location of this test and during the period when the dusts were being applied. Supplementary tests indicate that even with these frequent rains five and perhaps four applications of copper dust would have been sufficient to give good control of the bacterial pustule disease. However, further tests must be made before definite recommendations can be given as to the number of applications of dust to make and amount to apply at each application.

Find Cause of Purple Seed Stain

Recent studies of the soybean purple-seed disease in North Carolina show conclusively that it is caused by a parasitic fungus fitting the description of *Cercosporina kuikuchii*, a fungus that causes a similar disease in the Orient. The use of seed treatment dusts such as Arasan on purple stained seeds was found to decrease seedling losses significantly.

The fungus causing this disease forms spores abundantly on seedlings growing from purple stained seeds. Infections hitherto unrecognized have been identified on stems, leaves and pods. When heavily infected seeds are planted, germination is reduced by the disease and weak, stunted plants result.

Seed Treatment May Improve Stands

Each of six soybean seed lots were divided into 10 portions, nine being given different dust treatments and one being used as an untreated control. The treated and untreated portions of all seed lots were planted at three locations — Plymouth, Rocky Mount, and McCullers—in an effort to determine if seed treatment would result in worthwhile increases in seedling stands.

When the seedling stand counts from the three locations were averaged, it was found that all treatments gave some increase in number of plants. For most of the chemicals used, however, the increases due to seed treatment were too small to be considered significant.

Of the nine treatments the one with Arasan produced significant increases most consistently. Out of a total of 18 chances by each treatment on all seed lots Arasan produced significant increases 11 times; DuBay 1452-F, five times; 5 per cent PMA, four times; and 2 per cent Ceresan, three times.

Certain seed lots were benefited more consistently by seed treatment than others. Out of 27 chances arising from the nine treatments used on each seed lot, significant increases occurred nine times on Herman, eight times on

Rose Non-Pop, four times on Volstate, and two times on the Ogden variety.

The average increase for the six seed lots treated with Arasan was 13.1 per cent at Plymouth, 11.8 per cent at Rocky Mount, and 9.3 per cent at McCullers. The average increase for the two seed lots which benefited most from treatment with Arasan was 18.6 per cent at Plymouth, 32.6 per cent at Rocky Mount, and 17.4 per cent at McCullers.

On the basis of results obtained over a three-year period Arasan is regarded as the most suitable material now commercially available for seed treatment of soybeans.

SMALL GRAINS

Wheat Fails to Respond to Potash in 1945 Tests

Experiments on top dressing wheat with potash at 10 different locations on private farms in 1945 did not show any increase in yield over the no potash top-dressing. (Fig. 31).

A top-dressing of 30 pounds of nitrogen (187 pounds nitrate of soda) increased the yield in seven out of 10 fields. In the other three fields adequate nitrogen was supplied by the preceding legume crops. Thirty pounds of potash supplied by 48 pounds of muriate of potash in addition to the 30 pounds of nitrogen did not produce any increase in yield of wheat beyond that produced by the nitrogen application.

If cotton or other heavily fertilized crops, such as tobacco and truck, predominate in the rotation, small grains seldom respond to direct applications of potash. This evidence favors applying the potash to the crop or crops that respond most.

Spring and Late Fall Seeded Oats Responsible for Lower Yields

Spring and late fall seedings of oats produce less yields than seedings

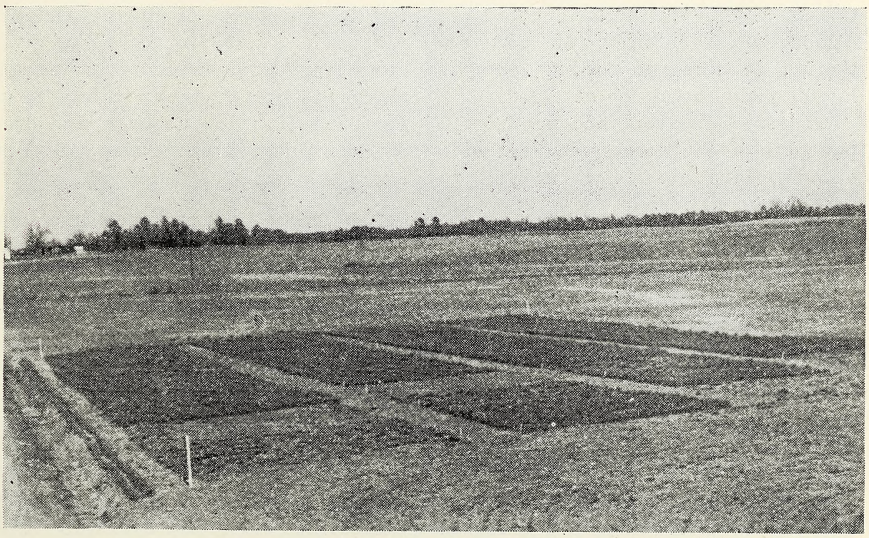


FIG. 30. A TYPICAL SMALL GRAIN EXPERIMENT IN WHICH IT HAS BEEN PROVED THAT THE STATE'S AVERAGE YIELD OF WHEAT, OATS AND BARLEY CAN BE MORE THAN DOUBLED BY IMPROVED FERTILIZER PRACTICES.

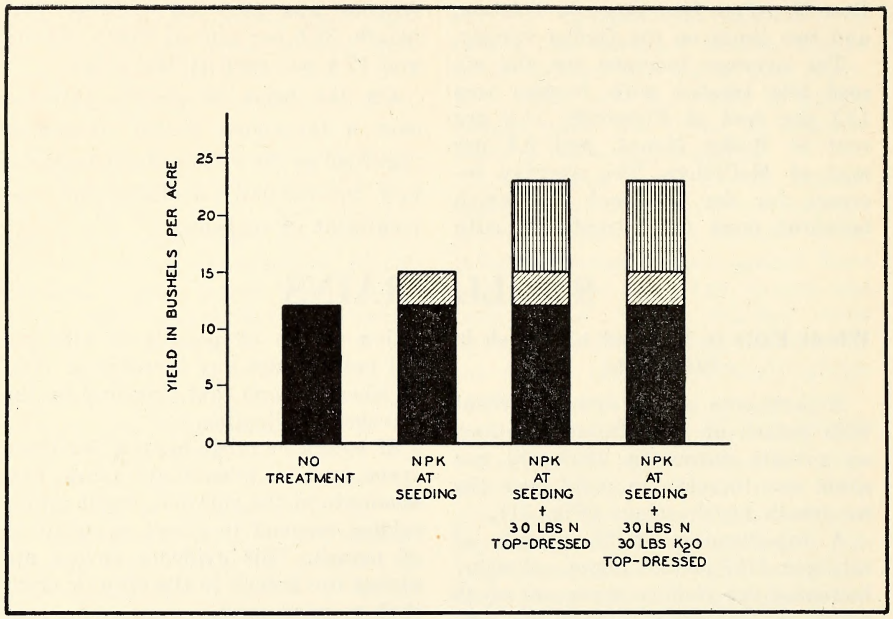


FIG. 31. WHEAT YIELDS NOT INCREASED FROM A TOP-DRESSING OF POTASH. (NPK = NITROGEN, PHOSPHORUS, POTASSIUM)

made in October. (Fig 32) An experiment conducted on a typical Coastal Plain soil following tobacco demonstrates the need for more attention to time of seeding oats if higher yields are to be obtained.

At least 5 per cent and possibly 10 per cent of the acres seeded in oats annually are abandoned or fail to produce enough yield to justify harvesting. This means that 15,000 or more bushels of seed oats and much labor are lost in this abandonment each year.

Late fall and late spring seedings are usually the ones abandoned. (Fig. 33) The late fall seedings are often winter killed, while the late spring seedings are often subjected to a period of insufficient rainfall or inadequate moisture. These hazards can be lessened if seedings are made in October. (Fig. 34)

Not only are the yields of oats influenced by the time they are seeded but other important factors as well. Seeding on time, or during October reduces soil loss from erosion, gives more vegetative winter cover, provides better stands and growth of lespedeza that follows oats, and even gives weed control in the oat crop, and lespedeza that follow it.

New Oats Variety for Piedmont

Lemont oats, previously designated as selection 1083B2-1, from a cross of Lee x Winter Fulgum, made a splendid record in 1945. It is being increased and the first certified seed will be available for general distribution in the Piedmont section of the state this fall.

As an average for the period 1939-45, on the Piedmont Branch Station, Statesville, Lemont averaged 89.3 bushels as compared with 75.4 for Lee 5, 74.5 for Fulwin, and 72.8 for

Letoria. In Official Variety Tests in Cleveland County for the four-year period 1942-45, Lemont produced an average yield of 75.4 bushels to the acre, as compared with 67.7 for Fulgrain 3, the next highest yielding variety. In these tests yields of 62.1 and 57.6 were secured with Fulwin and Lee 5, respectively.

In Guilford and Alamance counties (in tests covering the same period) Lemont led by a much smaller margin. In this area Lemont averaged 66.3 bushels as compared with 65.0 bushels for Stanton, the second highest variety.

Lemont has no resistance to rust and its straw is only fair. On soils of extra high fertility it has shown a tendency to lodge. On medium to good soils, however, very little evidence of this has been seen. Its general vigor tends to offset the above mentioned weaknesses and to make it a variety that should be tried rather widely in the Piedmont area.

On fields of extra high fertility where lodging might be a factor, however, Letoria or Stanton (medium early in maturity) or Victorgrain (early) should be used).

Oats Test Promising In Coastal Plain

An oat variety test was conducted on the new station at Plymouth for the first time in 1944-45. For this test the same varieties and strains entered in the advanced variety test at Statesville and at McCullers were used. Some wheat and barley were also grown on this Station, but did not appear to be so well adapted as was the oats crop.

Crown rust was severe and affected the yields of all susceptible varieties of oats, causing a great deal of lodging just before harvest. In this test, Letoria, one of the better rust resistant varieties, led all named varieties with a yield of 71.7 bushels. Other promising varieties in this test, and in the Official Variety Tests conducted in the Coastal Plain area are Stanton and Fulgrain 3.

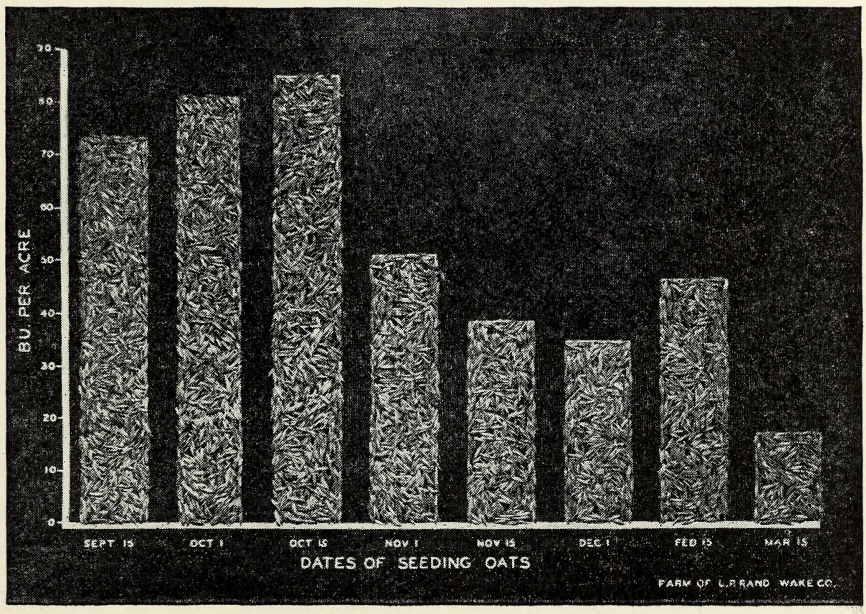


FIG. 32. DATE FOR SEEDING OATS INFLUENCES YIELDS.

Oats for Winter Grazing and Hay Production

Because of increased interest in the use of small grain as winter grazing crops and in combinations for hay, careful notes were taken on the 1945 tests as to the relative amounts of winter growth made by the different varieties of oats and straw yields were taken on the harvested bundles.

On March 1 Lemont led all other varieties in amount of winter growth with the exception of Fulgrain 3, the earliest strain in the test. In straw yields, as an average for Statesville, McCullers, and Plymouth, varieties now being grown in North Carolina produced as follows: Lemont, 4,323 pounds per acre; Letoria, 4,296; Lee 5, 4,271; Fulwin, 3,916; Stanton, 3,635; Fulghum, 3,375; Victorgrain, 2,692, and Fulgrain 3, 2,500. There was one variety from Georgia, Lega, that exceeded the highest of these, with a yield of 4,794 pounds.

Lemont has demonstrated its value for winter grazing and for high production of grain. Where a variety is desired for hay production, however, Letoria will probably be more widely acceptable, as it is rust resistant (rust is often a factor in producing quality hay) and has a fairly strong straw.

Disease Resistant Barleys Under Test

In 1945, for the first time since barley breeding work was initiated by the Station, leaf rust was of major importance. (Fig. 35) This disease, together with a late spring freeze, hit barley a hard lick. There are no known rust resistant varieties adapted to this area, but, fortunately, there were in the nurseries at Statesville and McCullers a large number of selections from crosses of Bolivia and Chevron (resistant types) on locally adapted varieties like Sunrise, Iredell and Davidson. Some of these showed resistance to the disease and exceeded the Sunrise variety in yield.

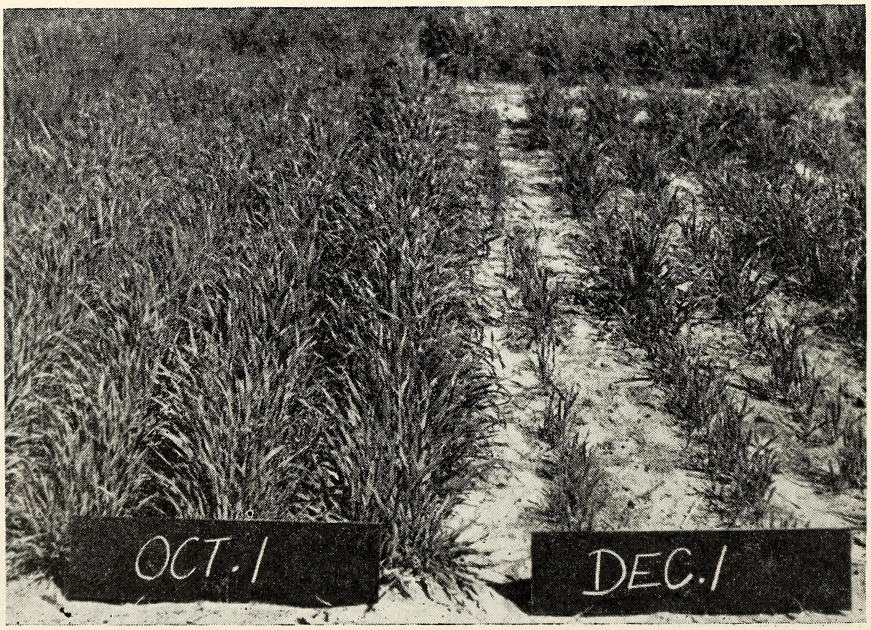


FIG. 33. EARLY FALL SEEDING VS. LATE FALL SEEDING.

FIG. 34. SPRING SEEDING VS. FALL SEEDING.

Another promising group of selections tested in 1945 was from crosses of Sunrise on Davidson and on Hooded 26. A good many of these were known to be mildew resistant like the Sunrise parent, and according to inoculation tests carried out in 1944-45, a number also carried resistance to brown loose smut. (Fig. 36) Resistance to both diseases in a single well-adapted variety would be of real value to the barley growers of the state.

New strains from either of the above groups cannot be made available immediately, but further testing of these will be carried forward as rapidly as possible.

New Wheat Strain for Western Carolina

A rust resistant selection of the Fulcaster type of wheat has been developed at the Piedmont Branch Station, Statesville, and is being increased for general distribution in the Western part of the state. This is strain 3 from a cross of the rust resistant Malakoff x Nittany. The latter variety is a standard strain of Fulcaster.

As an average for the past six years at Statesville and the past four years at the McCullers Branch Station, this strain and two sister selections have led the yield tests. At Statesville, Malakoff x Nittany strain 3 has averaged 36.7 bushels per acre during this period as against 34.6 for Nittany, 33.6 for Redhart, and 32.1 for Carala.

At McCullers the yields of these varieties were as follows: Malakoff x Nittany strain 3, 29.2 bushels; Redhart 5, 28.1; Nittany, 26.9; and Carala, 25.7. Hardired is the only variety that has exceeded this new strain in yield but it was not in the tests for the full period.

FIG. 35. RUST TOOK A HEAVY TOLL FROM THE 1945 BARLEY CROP. HERE, THE SUNRISE VARIETY IS SEEN LODGED. HOODED 26, THE VARIETY ON THE LEFT, WAS ONLY PARTIALLY LODGED AT THE TIME THE PICTURE WAS MADE BUT WENT DOWN A FEW DAYS LATER.

Promising New Wheat Under Test

What seems to be a most promising group of wheats are some new rust resistant selections from the cross Frondoso x (Redhart x Noll). Some of the hybrid material, which was received from the Division of Cereal Crops and Diseases in the fall of 1941, have now been in yield test for two years. Eleven of these selections were in the Advanced Test in 1945. These, together with certain strains of Hardired, were the two most promising types tested. As a group, they have stiff straw, are beardless, have good rust resistance, and produce good yields.

A second group of 43 selections from this cross, together with a few standards, showed the superiority of this group of selections. With the exception of Hardired 3 which ranked seventh in the test, all selections from this cross exceeded the standard varieties.

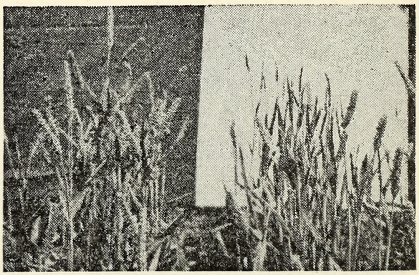


FIG. 36. MILDEW RESISTANT SELECTIONS FROM CROSSES OF SUNRISE X DAVIDSON AND HOODED 26 WERE TESTED FOR SUSCEPTIBILITY TO BROWN LOOSE SMUT. SOME WERE FOUND RESISTANT, OTHERS COMPLETELY SUSCEPTIBLE.

TOBACCO

Effects of Cropping Sequences on Root Knot and Yield

Effects of cropping practices on root knot infection and yield of tobacco have been under investigation at the McCullers Branch Experiment Station for the past nine years. In these studies cropping sequences were set up on a 2-, 3- and 4-year basis. Crops represented included: corn, cotton, crotalaria, peanuts, oats, weeds, and continuous tobacco.

The most outstanding of the crop rotations under test is a cropping sequence where tobacco is planted every fourth year. The complete sequence is cotton, corn, peanuts and tobacco. In 1944 and 1945, after this cropping rotation had been continued for eight and nine years, yields of tobacco per acre averaged 1,361 pounds, whereas on adjoining land which had been cropped to tobacco continuously during this period the average was 972 pounds per acre. The amount of fertilizer used, date of planting, date of each cultivation and all other factors were the same for these two practices. Tobacco in the four-year rotation had almost no root knot whereas tobacco in the continuous tobacco plots was seriously affected.

A cropping sequence where tobacco is planted every third year has also proved very satisfactory from the standpoint of both yield and disease control. Table 2 gives the most outstanding three-year rotations and how they compare with continuous tobacco.

The two-year cropping sequence decreased the amount of disease but usually had little effect on the yield. However, sequence of peanuts and tobacco produced 1329 pounds of tobacco and reduced the root knot to an index of 3.5.

In general, when weeds were included in the cropping sequence the yield and quality of tobacco was very good. But if the rotation consisted of weeds alone, root knot was only moderately controlled. A sequence of cotton and weeds, or peanuts and weeds, maintained the yield and quality and greatly reduced the disease.

In a cropping sequence where tobacco follows cotton, the amount of root knot infection is markedly reduced but yields are adversely affected and the plants appear stunted. Following peanuts, tobacco is almost free of root knot infection, yields are good and the plants make normal growth, but the quality may not be all that is desired.

Uramon Plus Cyanamid is Good Treatment for Plant Bed Soils

Uramon and cyanamid were tested on approximately 5,000 square yards of farmers' tobacco plant beds during

TABLE 2

CROPS PLANTED			Total yield of Tobacco	Disease index of Tobacco
1943	1944	1945	1945	1945[1]
Cotton	Weeds	Tobacco	1227	0.8
Cotton	Peanuts	Tobacco	1285	1.6
Cotton	Corn	Tobacco	1276	1.8
Peanuts	Oats & Weeds	Tobacco	1305	12.3
Tobacco	Tobacco	Tobacco	1000	91.5

[1] On the disease index scale, 0 represents no root knot infection and 100 represents maximum infection. This figure is obtained by classifying the tobacco roots according to the degree of infection.

the 1945 season. Any implement which thoroughly mixed the material into the upper three or four inches of the soil at the time of treatment in the fall gave satisfactory results. Depth of cultivation at sowing time was the most critical factor in determining degree of weed control. Satisfactory results were obtained on beds cultivated lightly with a spike-tooth harrow or similar implement, while no weed control was evident on a treated bed cultivated to a depth of five or more inches at seeding time with a three-tooth cultivator.

In a comparison of materials and rates, uramon one pound, cyanamid one pound, uramon one pound plus cyanamid 0.25 pound, or cyanamid 0.50 pound or cyanamid 0.75 pound per square yard were tested. The number of weed seedlings per square foot averaged 33.5, 32.2, 14.2, 8.3 and 10.2, respectively, per square foot for these five treatments. The outstanding treatment was uramon one pound plus cyanamid 0.50 pound per square yard, as this combination of materials gave increased weed control and yielded over four times as many tobacco transplants at the first pulling as either of these materials used singly at the rate of one pound per square yard.

Oxford 26 Tobacco Meeting Success

Oxford 26 was grown extensively in 1945 with excellent results. The tobacco crop on wilt infested farms equaled and in many cases exceeded, the state average in yield and quality of cured leaf, a development of much economic benefit to the growers of the over 40,000 acres of tobacco, who grew this variety (Fig. 37). Fifty F_3 or F_5 lines from the cross of T.I. 448A x 400 x 401 were evaluated for yield, resistance and apparent quality. A few lines exceeded Oxford 26 in total yield, but none proved superior in resistance or color of cured leaf.

FIG. 37. FIELD OF OXFORD 26 GROWING NEAR HESTER, ON A FARM WHERE GRANVILLE WILT HAD DESTROYED OVER 50 PER CENT OF THE CROP IN PAST YEARS.

Oxford 1, 2, 3 Show Blackshank Resistance

In a comparison of blackshank resistance on a total of 13 replications during 1944 and 1945, Oxford 1, 2 and 3 averaged 29.0, 5.9 and 7.9 per cent diseased plants, respectively. Comparable plantings of their resistant parent, Florida 301, averaged 9.6 per cent blackshank, indicating that the full resistance was recovered in Oxford 2 and 3. Reports from farmers and county agents of the Extension Service showed Oxford 1 to be superior in apparent quality, however, over a two-year period "400" and Gold Dollar averaged 98 to 100 per cent kill of plants at the end of the season, but counts made in July showed "400" to be extremely susceptible, averaging 23.1 per cent more blackshank than Gold Dollar.

Soybeans Before Tobacco Furnish Nitrogen

Soybeans when used in a rotation with tobacco, in a two-year rotation on coarse sandy loam soils, have proved a very satisfactory source of nitrogen. The yield of tobacco for a seven-year period on the eight experimental plots averaged 1404 pounds per acre. The average value of the tobacco produced per acre was $480.12, and the average price was $34.20 per 100 pounds of tobacco. The quality of the leaf was superior, as indicated by these market prices.

The rotation is tobacco followed by oats. In season the oats are cut for hay. They are followed by soybeans which are broadcast. When the beans are mature, they are harvested for seed, and the remainder of the soybean plants are disked and plowed under in the fall. Rye follows the soybeans, and is plowed under in the spring.

The fertilizer treatment ranged from a 0 - 10 - 6 to a 0 - 10 - 12 and a 0 - 10 - 24, however, a degree of caution should always be used when tobacco is planted after any legume, as a high percentage of nitrogen in the cured leaf is objectionable.

FORESTRY

New Equipment at Weather and Fire Danger Station

The Hofmann Forest Weather Station in Onslow County has been completed by the addition of a hygrograph, standard rain gauge, evaporation tank with hook gauge, and soil water level well with recorder. (Fig. 38)

The station has been approved as a cooperating evaporation station by the United States Weather Bureau. As a result, a monthly report will be sent to the Weather Bureau Office at Raleigh.

To broaden the scope of fire danger studies on the Hofmann Forest, substations made up of a soil water level well with recorder, air and soil thermograph, hygrograph, and standard rain gauge will be established at selected locations. Equipment for the first of these has been obtained and will be installed during 1946.

Steers Show Preference in Forest Grazing

Spring grazing tests in Piedmont forest types have been carried through two years and have demonstrated that the amount of browsing damage to trees was dependent first of all on the size of the tree itself. Browsing damage was limited mainly to seedling and sapling sizes. For this reason the data presented here were limited to trees 1 inch d.b.h.[1] and smaller. Larger trees received only minor damage to the lower branches. The yearling steers used in the tests would not reach up over about five feet to browse.

The steers showed a definite liking for some trees (Fig. 39), particularly, yellow poplar, black gum, ash, redbud, and a number of other trees of secondary importance such as elm, black cherry, mulberry, sourwood, black haw, and blue beech. Browsing damage to some of these trees was very severe. Breakage was high in yellow poplar and ash. Black gum and redbud, although invariably damaged heavily, were seldom broken. In the test pastures, trees of the two latter species averaged less than six feet in height, hence, they could be almost completely defoliated by the steers without being bent or broken.

Red maple, dogwood, and red gum seldom suffered the loss of more than the ends of several lateral branches, however, the leaders of some of the smaller trees were torn off.

A direct relationship existed between the available amount of non-tree forage, such as herbage, grasses, and vines, which made up the bulk of the food material taken by the steers, and the browsing damage to the trees. This can be seen by the differences between the percentages for the two pastures, Figure 39. For all trees, the percentages were less in the moderately grazed pasture.

[1] Diameter at breast height or 4½ feet above the ground.

The influence of the supply of forage on tree damage was also shown by an increase in damage to certain trees as the grazing season advanced. During the last three weeks of the eight-week 1945 season, available forage was limited. Browsing damage to trees increased to the extent that the steers rode down yellow poplar and ash trees, Figure 40, to get at the luxuriant, unbrowsed leaves and shoots in the tops. By the end of the grazing period, 26 per cent of the yellow poplar and 40 per cent of the ash in the heavily grazed pasture had been so damaged. Similar damage occurred to only about 5 per cent of these trees in the moderately grazed pasture.

Loading Pulpwood in Coastal Areas

Pulpwood operators have found that in areas in which trucks cannot be brought into the woods to within 50 feet of the pulpwood bolts the cost of loading the wood makes the operation unprofitable. Particularly is this true in the hardwood bottoms along the Carolina Coast. Some other means of moving pulpwood out of the woods must be used if this type of timber is to be utilized.

Tests on operations in the Hofmann Forest demonstrated the utility of sleds drawn by a track tractor for this purpose. Observation of a pulpwood loading operation by the Reigel Paper Company on their holdings at Bolton, further demonstrated that

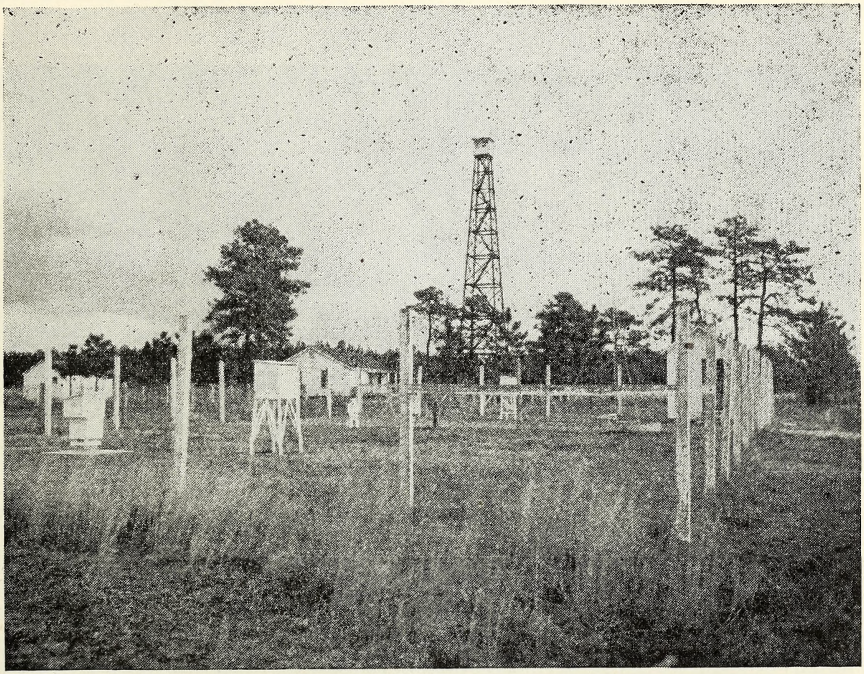


FIG. 38. HOFMANN FOREST WEATHER STATION. INSTRUMENTS, LEFT TO RIGHT: SOIL WATER TABLE WELL, SHELTER FOR HYGROGRAPH AND SOIL THERMOGRAPH, STANDARD AND TIPPING BUCKET RAINGAUGE, SHELTER FOR MAXIMUM AND MINIMUM THERMOMETERS AND AIR THERMOGRAPH, ANEMOMETER TOWER AND VANE, EVAPORATION PAN, AND HOUSE FOR INSTRUMENTS AND RECORDS. DEPPE FIRE TOWER IN BACKGROUND.

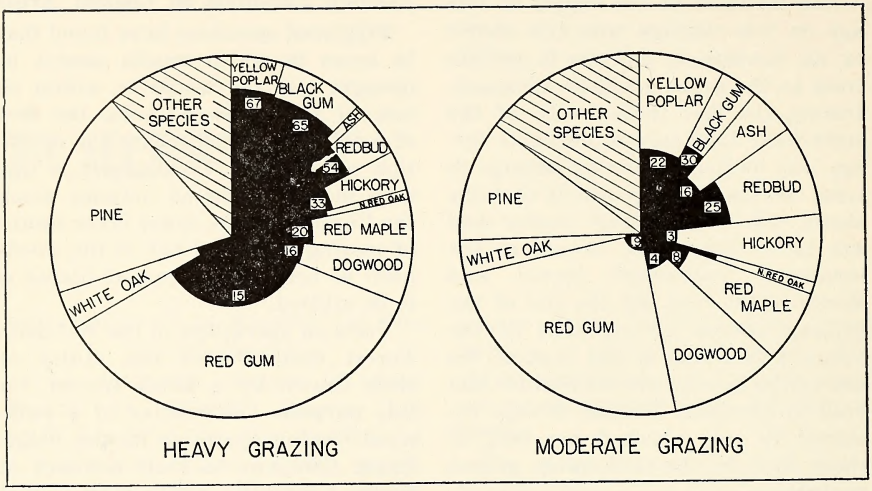


FIG. 39. EXTENT OF BROWSING ON TREES. THE DARKENED PORTION SHOWS THE PERCENTAGE OF BROWSED TREES IN THE SIZES FROM SMALL SEEDLINGS THROUGH THE 1-INCH D.B.H. CLASS. THE SIZE OF THE SECTOR SHOWS THE IMPORTANCE OF THE SPECIES IN THE STAND AS A WHOLE.

FIG. 40. YEARLING STEER RIDING DOWN A YELLOW POPLAR SAPLING.

sleds could be used to eliminate much of the hand labor normally required in loading and hauling pulpwood. To test and develop the use of sleds in hauling pulpwood, a number of sleds were constructed of heavy oak timbers and also of steel to haul one unit of wood (160 cu. ft.). They were equipped with hinged rear uprights supported by a chain. By means of a cable the loaded sleds were drawn up an inclined ramp on to a truck equipped with bolsters to hold the wood. The truck bolsters had hinged uprights on the side from which the load was drawn up. After the loaded sled was on the truck the uprights on the truck bolsters were raised and those on the sled lowered. The sled was then pulled out from under the wood, leaving the wood on the truck and the sled available for another trip to the woods. The trucks were equipped to haul two units per trip.

At the railroad siding a cable was passed around the wood. One end of the cable was fastened to the car and the other to a tractor. The hinged uprights on the truck were then released to form a bridge from the truck to the car so that the entire unit of wood was pulled into the car at one time. Thus, in the loading operation, the only hand labor required was to load the sleds and to stack the wood in the boxcar.

HORTICULTURAL CROPS

SMALL FRUITS

Dusting Blueberry Bushes for Cranberry Fruitworm

Dusting on three North Carolina blueberry farms during 1945 greatly reduced the number of berries destroyed by the cranberry fruitworm as compared to the damage done by this insect during the previous year.

The number of withered berries on undusted check bushes was 6.5 times as great as on bushes dusted with 3 per cent DDT dust and 7.7 times as great as on bushes dusted with 70 per cent cryolite. The dust was applied by power dusters (Fig. 41) and timed by observations on the life history of the insect. Due to prolonged dry weather in early April, one application of dust was found to give satisfactory control. The dusts were applied at night to take advantage of the calm night air.

The cranberry fruitworm is a yellowish green worm that feeds on the berries. It starts when the berries are small and green and passes from one berry to another webbing them together as it goes. It has increased in numbers and destructiveness during the past two years.

Tests With New Dewberry Selections

The yield and size of fruit of three of the most promising dewberry selections for 1945 in comparison with some of the standard varieties are shown in Table 3. Each of the new selections yielded almost twice as much fruit and had larger berries than Lucretia.

TABLE 3.
Yield and Size of Fruit of Dewberry Varieties and Selections.

Variety	Yield in Quarts per 100 plants	Number of Berries per Quart
Lucretia	173	212
Cameron	343	225
Youngberry	226	147
Boysenberry	243	118
W-45	326	164
38 - 7 - 3	326	176
39 - 11 - 13	393	194

New Strawberry Looks Good

In a test of 15 strawberry varieties and 10 selected hybrids at the McCullers Experiment Station, Midland outyielded all other varieties and selections. This new variety, recently released by the USDA, produced at the rate of 278 crates per acre compared with 191 crates each for Blakemore and Massey. In addition, Midland is high in vitamin C and is well adapted to freezing. It is worth a trial in the Piedmont and Mountain sections as a home and local market variety.

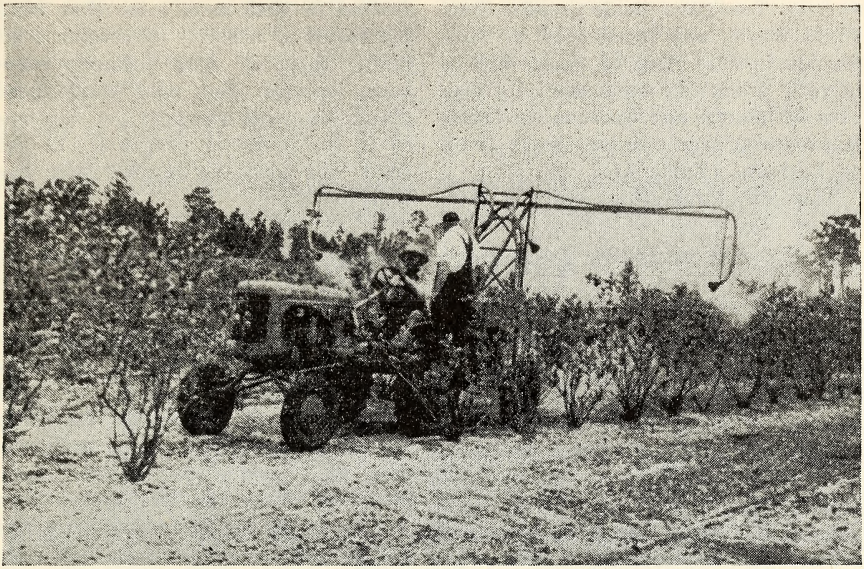


FIG. 41. DUSTING BLUEBERRIES FOR THE CONTROL OF CRANBERRY FRUITWORM, AT IVANHOE, N. C.

Contrary to the results at McCullers, Midland was not so well adapted to conditions in the southeastern part of the state. In a test of 25 varieties and selections at the Coastal Plain Station, Fairfax and NC 1039 were the highest yielders. Fairfax has proved to be a good parent in breeding, but is too dark for commercial use in the Eastern part of the state. NC 1039 has outyielded both Blakemore and Massey at the Coastal Plain Station during the past two seasons. It is about the color, size, and season of Massey, and shows promise of being a good companion berry to Blakemore and Massey.

Of the selections under test at the Coastal Plain Station, five were earlier than Blakemore, but none was later than Massey during the 1945 season. Of the 25 varieties and selections under test, seven were equal to but none was larger than Massey. Of the named varieties, Blakemore and Massey still seem to be the best combination for the region represented by the tests at the Coastal Plain Station.

TABLE 4.

Yield and Size of Red Raspberry Selections.

Variety	Yield in pints per 100 plants	Number of berries per pint
Latham	184	159
Dixie	294	269
37-6-4	211	194
38-16-12	387	304
38-16-15	292	250
40-7-6	437	155

New Raspberry Selections Show Promise

Several new red raspberry selections are now being tested for performance under field conditions. In the 1945 season four of these produced yields much greater than Latham, which was used as a standard

variety. Two gave yields greater than Dixie which was introduced by this Station in 1937. One of these, 40-7-6, is very promising because of its disease resistance and fine quality fruit. It produced over twice as much fruit as Latham. (Table 4).

The most interesting seedlings that fruited in 1945 were some that were the result of a series of crosses combining three or four different raspberry species. Not only were these plants the most vigorous yet developed in the breeding program, but the fruit was also the largest that has been produced.

TRUCK CROPS

Studies Continued on the Control of Root Knot of Vegetable Crops

At McCullers Branch Experiment Station, studies were continued in 1945 in an effort to develop a practical method for controlling root knot in the home garden.

In four distinct but related experiments, chemical treatments were applied to soils naturally infested with the root knot mematode on the following dates: March 11, 1943; November 2, 1943; April 6, 1944, and October 30, 1944. As in previous years, susceptible test crops of okra, squash, tomatoes and beans were planted in 1945 and data on stand, yield, and root knot severity were obtained.

Average root knot indices for the four crops in each test are summarized in Table 5. These figures show that root knot control was still comparatively good in second and third year plantings, especially following sodium nitrate at ½ pound and uramon at 1 pound per square yard. However, in the first planting on plots treated in the fall of 1944, control was not as good as in previous first year tests. This was probably due in part to the fact that the soils were unusually heavily infested and contained some incompletely decayed roots of a previous crop of tomatoes at the time of treatment.

As in previous tests, yields were markedly depressed on first year plantings of all four crops following treatment with uramon and on beans following sodium nitrite. However,

TABLE 5.

Effect of chemical treatments at stated dates on control of root knot in 1945.

Date Applied	Root Knot Index[1]					
	Sodium Nitrite		Uramon		Chloropicrin	Check
	¼ pound per sq. yd.	½ pound per sq. yd.	½ pound per sq. yd.	1 pound per sq. yd.	27 CC per sq. yd.	No Treatment
March 11, 1943 (3rd plantings)	21	9	12	5	14	63
Nov. 2, 1943 (2nd planting)		7	19	7	15	57
April 6, 1944 (2nd planting)	9	5	10	7	9	49
Oct. 30 1944 (1st planting)		10		7	33	77

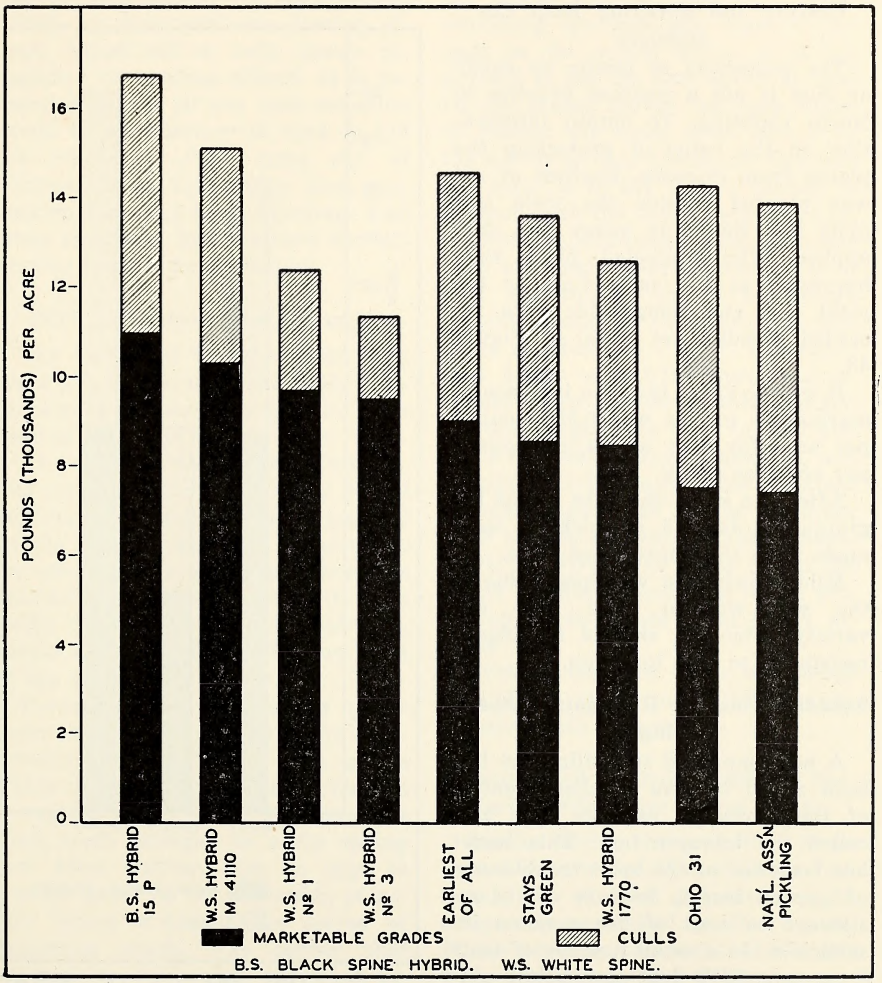
[1] An index of 0 equals no root knot; 100 equals maximum severity.

yield data on the second and third year plantings indicated that such toxic effects largely disappear after the first year.

Results of Cucumber Variety Studies

To compare standard varieties of cucumbers and recent introductions for both yield and processing quality, tests were begun in 1945 at the McCullers Branch Experiment Station near Raleigh. Nine varieties were included in the experiment and the results are reported in Figure 42.

The 1945 growing season was unusual in many respects as it produced some very adverse weather. Harvest-



CUCUMBER YIELDS RANKED IN ORDER OF MARKETABLE GRADES. POUNDS (THOUSANDS) PER ACRE.

FIG. 42.

ing began on June 20 but this time harvesting was impossible and accounts, in part, for the large number of culls produced.

It is significant to note the low position of National Association Pickling in the graph as this variety has been extensively used for processing.

Dusting and Spraying Help Cucumbers

The protection of plants by spray or dust is not a common practice in North Carolina. To obtain information on the value of protecting the plants from diseases, Earliest of All was planted outside the yield test plots and Bordeaux spray and dust applied. The protected plots were harvested at the same time as the yield test and comparable data recorded. Results are given in Figure 43.

It will be noted that the increase in marketable grades was 6,355 pounds per acre for dust and 4,780 pounds per acre for spray.

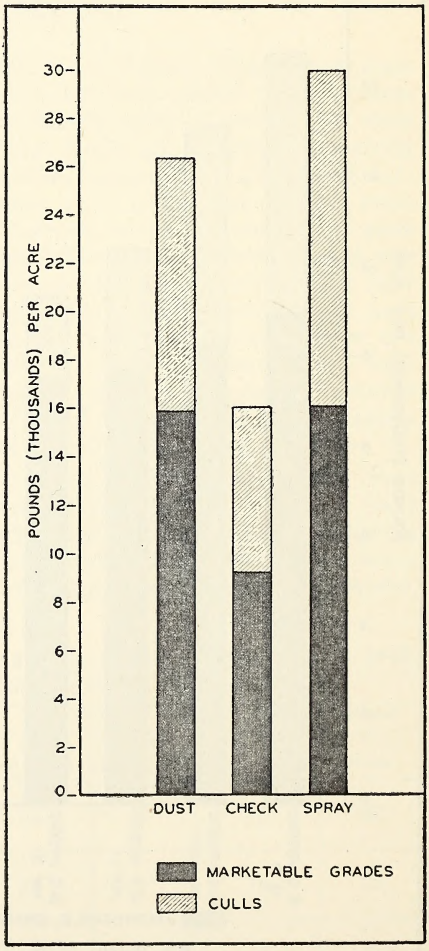
After the seven-day rain period beginning on July 13, six pickings were made from the unprotected plots.

Mildew infection was heavy due to the wet weather, and only one variety, Ohio 31, showed significant resistance to this infection.

Sabadilla Dust for Harlequin Cabbage Bug

A new improved sabadilla dust has been found to give excellent control of the harlequin cabbage bug, also called the terrapin bug. This insect has been one of the most troublesome of garden insects because of its resistance to most of the common insecticides. In a small number of tests 3 per cent DDT dust gave better control than 1 per cent rotenone dust which has been recommended for a number of years as the best remedy for the bug. Sabadilla killed more harlequin bugs than either rotenone or DDT and did it in a fraction of the time required by either of these insecticides. Sabadilla is a war-time substitute insecticide prepared from the seeds of a tropical American plant.

Counts of living and dead bugs on seeding collars dusted in May and counted after two days, showed 100



THE EFFECT OF SPRAY AND DUST ON MARKETABLE GRADES. VARIETY, EARLIEST OF ALL.
FIG. 43.

per cent dead with 20 per cent sabadilla dust, 96 per cent dead with 10 per cent sabadilla, 83 per cent dead with 3 per cent DDT, and 8 per cent dead with 1 per cent rotenone. Young harlequin bugs tested later in the spring proved more resistant and the 10 per cent sabadilla killed less than half of them, but 20 per cent sabadilla dropped 90 per cent of the young bugs within an hour and one dusting almost wiped out a very heavy infestation on seeding collars. It is believed that the 10 per cent sabadilla would be satisfactory if used to kill the adults as they come out of hibernation in the spring thus preventing the bugs from breeding. Fall crops should be also watched for migrating bugs in late summer.

DDT to Control Potato Insects

The larvae of the European corn borer are injurious to the Irish potato, causing extensive damage by their feeding activities in the vines.

As a potato pest in North Carolina, this insect is of comparatively recent importance. The borer first appeared on the Eastern shore of Virginia in the early 1930's and since then has gradually spread southward into North Carolina in the principal Irish potato districts of the Eastern part of the state.

There are three generations of the borer in this region. The borer overwinters as a larva in corn stalks where it changes to the pupal (cocoon or resting stage) in early spring. The adult moth emerges in early spring and, after mating, lays its eggs in a small patch on the underside of potato leaves or upon the leaves of numerous weeds. The larvae that hatch from these eggs are what attack potato vines, by boring into the vines and weakening them. The vines gradually turn yellow and may die prematurely.

To reduce the number of overwintering borers that may develop to the adult stage in the corn stalks, it is necessary to remove old corn stalks from the field and to plow under all corn stubble. This prevents the adult moths from emerging.

Control of the European corn borer attacking potatoes should begin when the moths emerge from their overwintering quarters and begin to lay eggs on the potato leaves. It is important to get the first spray or dust on the plants before the eggs hatch to protect the vines from injury by the worms as they hatch out. But once the borer is in the vine it cannot be reached with the usual methods of insecticidal application. Dust or spray used at weekly intervals for three or four applications should be enough to control most of the borers. In field trials at Elizabeth City, it was found that 3 per cent DDT dust was effective when applied in this manner.

Other insecticides tried in field plot trials included Ryanex, Sabadilla, and Cryolite. DDT treated plots remained greener longer than any of the other plots treated differently. The residual power of DDT is no doubt one of the major factors contributing to the protection of the vines from insect attacks.

Further test are to be considered with DDT alone and DDT in combination with a fungicide.

Treating Soil Controls Southern Bacterial Wilt After Three Years

Studies during the past three years have demonstrated that southern bacterial wilt of Irish potatoes can be adequately controlled in the Coastal Plains area by treatment of the soil with ammonium thiocyanate.

Whether this treatment will prove to be practicable depends upon, first, cost of treatment, second, the number of seasons the treatment will effective-

ly curb the disease and, third, whether the amount of chemical and time of application can be worked out so that crop yields will not be seriously affected. Some information on these questions has been obtained.

In field trials conducted in Pamlico County no disease appeared in plots planted in 1945 three years after treatment of wilt-infested areas. In adjoining untreated plots 10 per cent of the tubers were rotted. Other tests conducted to determine the most practicable rate of application showed that up to 250 pounds per acre of ammonium thiocyanate could be applied two months before planting without seriously reducing yields in the first crop. This rate of application gave nearly complete control of the disease. Further tests on time of treatment and carry-over effects are underway.

Weather Greatly Influenced Potato Diseases

The three diseases, southern bacterial wilt caused by a bacterium, southern root rot caused by a fungus, and sunscald, a non-parasitic disease caused by exposure to the sun, were of minor importance in 1945 in the Coastal Plains section. This situation was largely the result of unusual weather conditions. The three diseases require high temperatures for their development and the 1945 weather during the last part of the growing season and during the digging period in May and early June was markedly cooler than usual for these months.

The relatively cool weather, while unfavorable for these diseases, was, however, favorable for the development of late blight, a cool weather disease which is usually not serious in the Coastal Plains area on spring-planted Irish potatoes. Late blight attacks leaves and stems and causes tuber rots.

A third unusual disease situation that was widespread in 1945 had no relationship to the weather. This was the seed-borne virus disease called leaf roll, present in some fields on as many as 30 per cent of the plants. The yields of infected plants are usually about one-half to two-thirds that of healthy plants.

These observations on the marked influence of weather conditions on Irish potato diseases may serve as a reminder that diseases must be taken into account in any plans for increasing production of the fall crop of Irish potatoes in Eastern North Carolina. While tuber rots due to southern bacterial wilt, southern root rot and sun scald are likely to be reduced in fall-grown Irish Potatoes, increased trouble may be expected from early and late blight diseases that attack leaves and stems and cause tuber rots.

Phosphate in Irish Potato Fertilizer Depends on Amount Already in Soil

Considerable phosphate has accumulated in the commercial Irish potato soils as a result of annual applications of one ton of 6-8-6 per acre. This amount furnishes 160 pounds of phosphoric acid while the potato crop removes only 25 pounds. A soil study made in Richland Township, Beaufort County, revealed that the average content of all soils sampled was 893 pounds per acre of soluble phosphoric acid. In 1945 a series of experiments was begun to determine whether this accumulated phosphoric acid affected the amount necessary in the fertilizer. The experiments were placed on soils varying considerably in content of accumulated phosphoric acid and will be conducted at least three years.

The results of one year show that there was a decreased response to applied phosphoric acid as the amount already in the soil increased (Fig. 44). Increases in yield were obtained on

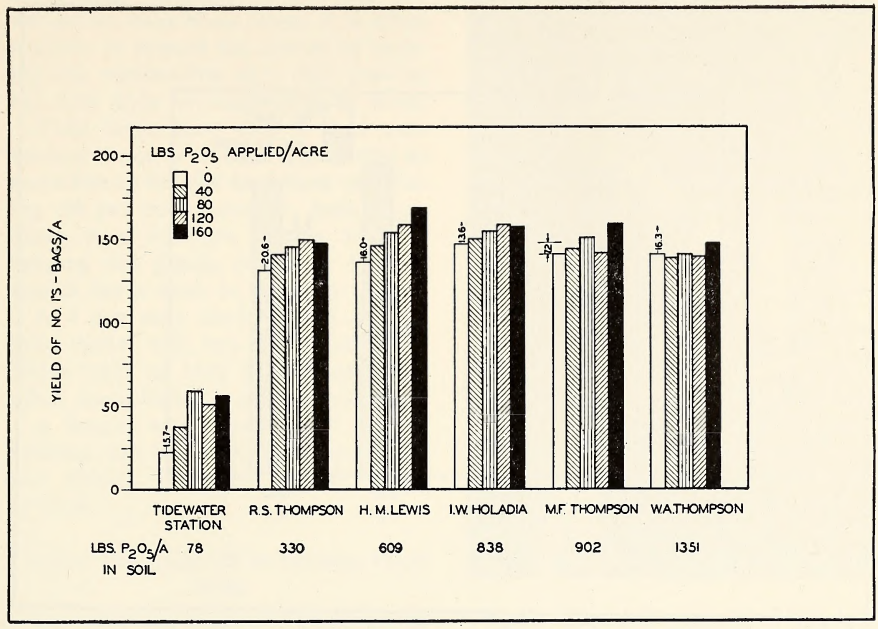


FIG. 44. IRISH POTATOES RESPOND TO ADDITIONS OF PHOSPHATE, PARTICULARLY ON THE SOILS CONTAINING LOW AMOUNTS OF SOLUBLE P_2O_5 (PHOSPHORIC ACID).

soils containing as high as 902 pounds of soluble phosphoric acid per acre. These data do not warrant recommending a reduction in the amount of phosphoric acid usually applied, 160 pounds per acre, on soils that contain less than 900 pounds.

Deep Placement of Lime Increases Yields of Irish Potatoes

Irish potato growers are committed to an acid system of farming because of the danger from scab. Consequently, calcium and magnesium are likely to be needed in their soils. Considerable attention the past three years has been directed toward supplying lime to the potato plant by placing it below the plow sole. In this position the lime can be reached by the potato roots but it does not increase the pH of the zone of tuber development and so encourage scab.

An experiment was conducted for three years on Lynchburg sandy loam in Pamlico County where lime was placed 10 inches deep in the bottom of each plow furrow. In 1944, when the growing season was relatively dry, this lime application increased yields 19 bags per acre and had no effect on scab. There was no effect on yield the other two years.

In 1945 an experiment was conducted on plots having different pH levels because of previous additions of three rates of sulfur in 1942. Soil analyses showed the lower pH values to be related to a lower content of calcium and magnesium. Without lime additions, the yield of potatoes was reduced on the plots receiving greater than 300 pounds of sulfur per acre (Fig. 45). With lime in the row 10 inches below the seed piece, yields

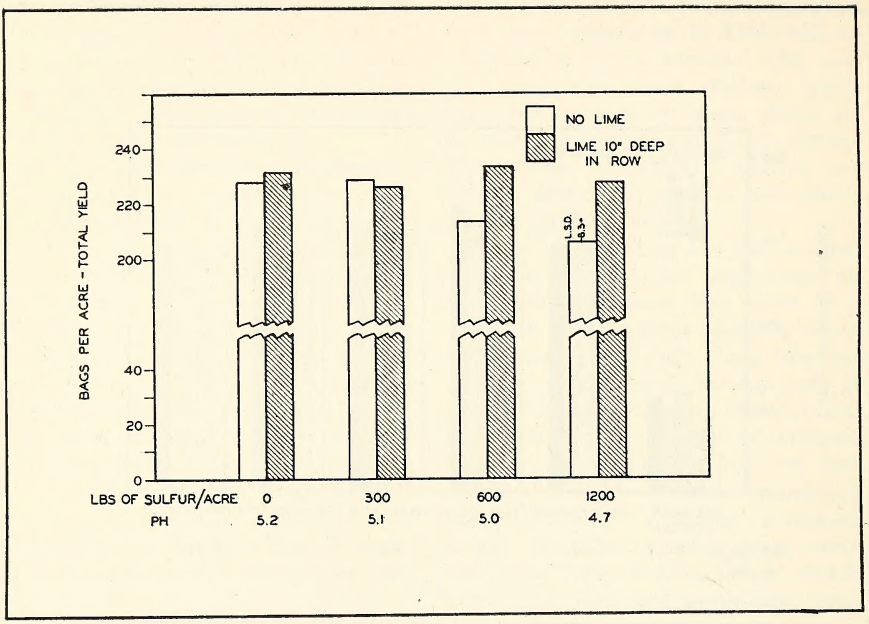


FIG. 45. IRISH POTATOES RESPOND TO DEEP PLACEMENT OF LIME ON SOILS OF HIGH ACIDITY.

were maintained regardless of the pH or rate of sulfur.

These results are encouraging from the standpoint of maintaining yields by deep placement of lime even at a relatively low pH and calcium level in the surface soil. Additional information is needed to identify more completely the environmental conditions under which a response may be expected, however.

Cockleburrs Turned Under Preceding Irish Potatoes Decrease Yields

In many fields in the commercial potato growing area cockleburrs are the usual type of vegetation growing up after potatoes are harvested. They are turned under either in the fall or in the winter for the next potato crop.

To obtain a measure of the effect of cockleburrs as compared to another type of organic matter or to no cover, an experiment was conducted at Raleigh in 1945 on a typical potato soil which was enclosed in concrete frames six feet square. The effect on potato yields of turning under cockleburrs or soybeans was determined.

The yields of No. 1 potatoes were as follows: After soybeans 226 bags per acre, after no cover 294 bags per acre, and after cockleburrs 161 bags per acre. A good growth of cockleburrs produces a high amount of organic matter but it apparently exerts an unfavorable influence. This experiment will be followed with field studies.

DDT Dust Controls the Pea Aphid

Pea aphids are especially bad on English peas (Fig. 46) where the peas are planted near fields of Austrian winter peas, alfalfa, or vetch. In these cases, it is usually necessary to use two applications of a dust to control

the aphids. However, if the peas are not grown near these crops, it is often possible to control the aphids by making one application of a dust just as the first pods are beginning to form.

Field tests show that a dust containing 5 per cent DDT has given as satisfactory results as a dust containing .75 per cent rotenone. Both these dusts were effective during 1945 in keeping the plants relatively free of aphids for a week to ten days.

A 4 per cent nicotine dust gave a good initial kill, but the aphid population built up very rapidly and thus often necessitated a second dusting.

A fungus was instrumental in controlling the pea aphid in many pea and alfalfa fields during the spring of 1945.

FIG. 46. PEA APHIDS ON ENGLISH PEAS. CONTROL MEASURES SHOULD BE APPLIED BEFORE APHIDS BECOME THIS NUMEROUS.

Control Damping-Off in Lettuce Plant Beds

In replicated tests at two locations in the commercial lettuce area, fermate and thiosan drenches were applied at rates of 1, 2, 4, and 8 grams, in ½ gallon of water per square yard. The variety Imperial 847 was used in both plantings and the seed were treated with spergon. The first application was made immediately after seeding and the treatment was repeated at 10- to 14-day intervals until the plants were ready for transplanting. Included in the same tests were modified treatments in which the first applications of thiosan at 2 grams and fermate at 8 grams per square yard were delayed until the plants had emerged.

No post-emergence damping-off was observed in any plot treated with two, four or eight grams of either material, while at the one gram rate an average loss of less than 1 per cent occurred. Damping-off in untreated check plots averaged 60 and 85 per cent, respectively, at the two locations. The treatments started after emergence were just as effective as those started at time of seeding. Additional tests indicated that fermate and thiosan drenches are not effective when application is delayed until after the disease has started to develop.

On the basis of these and previous studies, the following treatments are recommended for controlling damping-off in lettuce plant beds:

Treat all seed with either spergon or cuprocide before planting.

In choosing the plant bed site take care to provide good soil drainage, maximum exposure to sunlight and avoid seeding too thickly.

Treat the plant bed with either fermate or thiosan, one pound per 100 gallons of water, applied with a sprinkling pot at a rate of ½ gallon per square yard. Make the first application as soon as the plants are up and repeat at 10-day intervals throughout the plant bed season.

PEACHES

Control of White Peach Scale

Heavy infestations of the white peach scale will kill infested limbs (Fig. 47) or trees if control measures are not applied. Experiments conducted during 1944-45 have verified the results of the past two years that the most satisfactory control of the white peach scale is obtained by making two applications of a 3 per cent

FIG. 47. TREE PARTIALLY KILLED BY WHITE PEACH SCALE.

oil during the latter part of November or the fore part of December.

Experiments have indicated the possibility of controlling the white peach scale with DDT. However, the preliminary results have varied considerably, and a great deal more research work will be needed before specific recommendations can be made.

Fair Control of the Peach Tree Borer With DDT

Preliminary work with DDT for the control of the peach tree borer has indicated that fair control can be obtained when the material is sprayed on the trunk of the tree during August or the fore part of September. Material that is sprayed on the trees in the latter part of September and during October is not as effective. Neither is it effective to give the trees a single application the fore part of June.

In an experiment performed in a nursery during 1945, trees were sprayed with a water solution of DDT, one pound actual DDT per 100 gallons, on June 10, August 18, and September 20. Of the trees treated June 10, 14 per cent were wormy; of those treated August 18, 5 per cent were wormy; and on September 20, 22 per cent were wormy. Of the check trees, 35 per cent were wormy. A similar experiment was made in a commercial orchard, but the results of the treatments have not been checked.

LIVESTOCK and POULTRY

BEEF CATTLE AND HOGS

Amount of Concentrates Eaten Determines Gains and Condition of Steers in Feed Lot

Four trials, in which yearling beef steers were fed varying amounts of concentrates in the dry lot, were completed at the Animal Husbandry Farm at Raleigh in the spring of 1945. A summary of these trials brought out that the gains in the feed lot and final condition were in almost direct proportion to the amount of concentrates eaten, although satisfactory beef can be produced on two-thirds or even one-third of a full feed of barley.

From 18 to 21 grade Hereford yearling steers were used in each trial. They started on feed in the fall at approximately 800 pounds, divided into trios and individually fed the finishing ration of a full feed of lespedeza hay and different amounts of a mixture of 90 per cent coarsely ground barley and 10 per cent cottonseed meal. Group I received a full feed of the concentrate, Group II two-thirds as much as Group I, and Group III one-third as much as Group I. Each trio was slaughtered when one steer in the trio reached approximately 1,000 pounds.

The results of each of the four years the experiment was run were quite similar. The gains in the feed lot, the condition at slaughter and the dressing percentages were in almost direct proportion to the amount of concentrates eaten. The slaughter data showed that weight of cuts, depth and width of body, fat over rib eye muscle, and certain other factors were also apparently related to the amount of concentrates eaten. However, there was no apparent difference between Groups I and II in width of round, fat content of prime rib cuts and in thickness of fat over the loin. Neither was there any noticeable difference among the three groups in width of prime rib eye nor in size of short loin eye muscle.

While the steers receiving a full feed of barley produced more gain and finish, yet the gains and carcasses of the limited groups showed that satisfactory beef can be produced on less than a full feed of barley. This information is of special value to areas that produce an abundance of roughage, but are limited in their grain production.

Overgrazing Forest Range Doesn't Pay

Overgrazing forest range was found to be a poor practice in three trials with beef cattle conducted at the Hofmann Forest in Jones and Onslow Counties. Overgrazing caused the cattle gains and length of grazing season to be reduced and the stand of

reeds, which furnished the most desirable forage, to be severely injured.

Different rates of grazing were compared during the seasons of 1943, 1944 and 1945, with the grazing extending from approximately May 1 to September 1. Eight pastures of 48 acres each were used which gave four replicates. They were grazed with beef cows and their nursing calves (Fig. 48). In the first two trials the rate of stocking was nine cows and their calves for the heavy grazing and six cows and their calves for the moderate grazing. In the last trial this was reduced to six and four, respectively, because of a noticable reduction in reed forage due to overgrazing the two preceding seasons.

The normal grazing season in this area would extend to November but it was closed early in these tests because in the heavy grazed pastures practically all the palatable forage was consumed before November. The grazing was closed on both treatments at the same time so as to study the accumulative effects of the different rates of grazing on the forage.

In each of the three trials the gains of both the cows and calves were greater in the moderately grazed groups than in the more heavily grazed groups. The average seasonal gains per animal for the moderately grazed groups were 86 pounds for the cows and 162 pounds for the calves. This was an increase of 33 pounds and 10 pounds, respectively, over the heavily grazed groups.

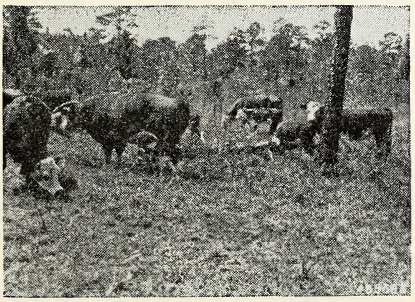


FIG. 48. WHERE THE FOREST RANGE IS NOT OVERGRAZED THE CATTLE ARE IN GOOD CONDITION AND THE CALVES MAKE SATISFACTORY GAINS.

Corn Cobs and Shucks for Fattening Beef Cattle

A feeding trial completed in the spring of 1945 with yearling beef steers at the Blackland Station at Wenona, showed that corn cobs and shucks may have a place in the ration for fattening cattle, as the steers on this feed made cheaper gains and returned more profit per steer and per bushel of corn fed than did those in the check group.

Two groups of steers were used, both given a full feed of corn and soybean hay, and two pounds per head daily of cottonseed meal. The corn fed to the check group was shelled and then coarsely ground, while the whole ears were coarsely ground without removing the shuck for that fed to the other group. For this the ears were "slip-shucked", that is, broken off from the stalk leaving the inner shucks attached to the grain, as is the custom in the principal corn producing areas.

For the 114 days feeding period the average daily gain for the check group was 2.21 pounds and for the other group 2.02 pounds, or approximately 20 pounds more in the ground corn group (check group). This group also ate less feed per unit of gain, but the steers receiving ground corn, cobs and shucks made cheaper gains and more profit. In each case, though, the difference was small.

The steers in the corn cob and shuck group did not get quite as fat as those in the check group, and in times when beef was in less demand would have no doubt sold for slightly less per pound. However, this trial indicates clearly that in times of high feed

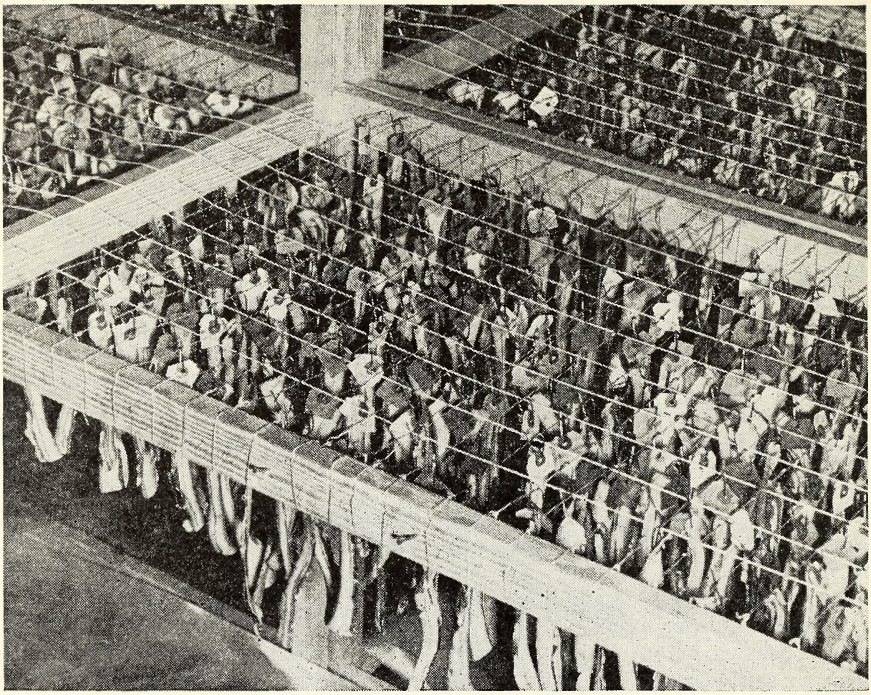


FIG. 49. PART OF THE BACON USED IN THE RANCIDITY TEST.

prices and limited meat supplies, the feeding of corn, cob and shuck meal is very practical. Furthermore, for inexperienced feeders, it is much safer to feed than shelled corn or corn meal, for being more bulky, there is less danger of animals going "off feed" or becoming foundered.

Rancidity in Cured Meats Can Be Controlled

The development of rancidity in cured meats and especially bacon is of apparent concern to all who cure meat for home use. The presence of rancidity can be detected by the strong fishy or tallowy flavor which it gives cured pork fat. Salted fatback and bacon are particularly subject to rancidity development.

Work at this Station has proved that rancidity development in cured meats, especially prevalent in bacon, can be controlled. Crude expeller process cottonseed oil was found to be the most effective means of control. Following this as an effective antioxidant were 4 per cent gossypol in refined vegetable oil, crude soybean oil, N.D.G.A., di-ascorbyl palmitate, refined hydrogenated cottonseed oil, refined cottonseed oil, and crude peanut oil.

Soybean-fed pork was found to be more subject to rancidity development than grain fed pork and treating cured meat with borax also speeded up the rancidity development.

Cured pork can be adequately protected by a number of the antioxidants mentioned. Since cottonseed and soybean oil are generally readily avail-

able it is suggested that they be used. Preference should be given to cottonseed oil because of its greater efficiency (Fig 49).

A thin coating of crude cottonseed oil was found so effective that bacon can be carried through the entire warm season of the year without becoming strong.

Storing the meat in a dark room or wrapping it in dark paper will further retard this development, and smoking the bacon before it is treated with the crude cottonseed oil will add even greater storage life to it.

The refined cottonsed oil, while effective for controlling rancidity, is much inferior to the crude oil, because the process of refining results in the removal of some of the agents that help to control the rancidity.

Applying the oil to the bacon is quite simple. The bacon may either be wiped over with a cloth that has been dipped in the oil, or the bacon itself may be dipped into the oil and then allowed to drain. The oil should be heated to room temperature before it is applied. This will allow the oil to spread more evenly over the whole piece. Only a thin coating of the oil is required for this process. Crude cottonseed oil may also be successfully applied to other cuts such as hams and shoulders. However, experiments have shown that if borax or anti-skipper compound is used with the oil the treatment will not be effective.

DAIRYING

Kudzu Gives Supplementary Grazing During Drought

Kudzu, a deep rooted legume which produces a dense ground cover, has produced ample grazing during drought periods at the Piedmont Dairy Research Farm at Statesville. For the past two grazing seasons kudzu has made it possible to keep up a normal milk flow during drought periods without increasing the supplementary feed. Kudzu, if properly managed, insures continuous grazing as it supplements permanent pastures and increases the number of days of actual grazing.

Early June grazing was not available in 1945 because of a killing frost on April 6 and 7. Kudzu had made a good growth, but the killing frost enabled the weed and briar growth to get a good start before the kudzu reappeared. The kudzu was grazed from June 1 to July 14 and again from August 26 to November 4.

Teat Disinfection in the Prevention of Mastitis

Pathogenic bacteria, which produce an inflammation of the mammary gland, usually enter through the teat canal. Therefore, a reduction of these bacteria on the teat surface near this area is desirable.

The ability of chlorine to reduce the bacterial population was compared with soap and water, and with a quaternary ammonia compound. The chlorine and quaternary ammonia compound solutions used contained 200 and 400 p.p.m. of active ingredients and were applied by dipping and washing. When dipping was used, the time interval was 30 seconds. The soap and water was applied by washing only. The check consisted of no treatment.

On the average, the chlorine and quaternary ammonia compound solutions gave slightly better reduction in bacterial populations than did soap and water.

Making of Hay or Silage Helps to Break Parasitic Cycle

In good grazing management, an attempt is made to reduce the parasite larvae by pasturing with immune animals. These immune animals graze the larvae infested grass and destroy large populations of larvae, thus preventing their consumption by susceptible animals. To determine the value of other management practices in reducing the numbers of infective larvae, vegetation with heavy larval populations of the cattle stomach worm were made into hay and silage at this Station.

Vegetation on greenhouse plats was fertilized with manure carrying a fairly high average egg count of 2,400 eggs per gram. This material was applied at the rate of 10 tons per acre on March 27, 1945. Larval counts on the vegetation were made during April and the first part of May, and the infestation was heavy.

Silage and hay were made from fairly heavy larval infested samples of the vegetation on May 19. Repeated examinations of these samples in December, 1945, have failed to show evidence of live larvae.

Therefore, hay or silage made from stomach worm infested vegetation, carrying condensed parasitic larval populations, may be harvested and used without risk.

Herd Replacements May Be Wintered Largely on Corn Silage

Thirty dairy heifers have been wintered on corn silage with limited protein supplements. In addition to all the corn silage they could eat, 15 received two pounds per head of cottonseed meal per day, and 15 others received one pound per head of cottonseed meal and five pounds of lespedeza hay per day. The heifers used in this study were approximately 14 months of age. The feeding periods were 100 days in length.

The heifers made satisfactory growth on both rations, were turned on good pastures, and later freshened in good condition. The shift from winter feed to pasture was gradual so as to avoid "setbacks" or losses in weight and condition.

The results obtained over a period of three years warrant the following conclusions:

1. Heifers can be wintered on good corn silage and two pounds of cottonseed meal per head per day, or
2. Heifers can be wintered on good corn silage, five pounds of good lespedeza hay, and one pound of cottonseed meal per head per day.

Use of DDT Around the Dairy Barn

DDT as a residual spray for the control of flies has been used very successfully in several dairy barns in the state. A wettable powder containing 20 per cent DDT was used at the rate of one pound in 10 gallons of water. This concentration sprayed on the walls and ceilings, mangers, and all other resting places of flies remained effective for two months and possibly longer. The spray was applied August 14 in one barn and records were kept on the number of dead flies found in a marked area each morning. There was considerable variation in the number of dead flies observed from day to day, but there were days during the early part of October that as many flies were found dead as when the material was first applied. It took longer, however, for the material to knock the flies down toward the end of the experiment, but even then practically all the flies disappeared by morning. After treating the barn, it was observed that flies were abundant in the

barns only for a short time every morning and evening when the cows were brought in from the pasture.

The spraying of the barn with DDT will greatly reduce the fly population. However, for the best results to be obtained, the windows and doors should be screened, and screens painted with a solution containing 5 per cent DDT. It would also be well to spray the walls and ceiling of the milk room with DDT, removing all equipment from the room, or covering it with papers during the spraying.

Experiments were also conducted on spraying the cows with DDT using wettable powder of the same concentration. This treatment greatly reduced the number of horn flies on the treated cows for a period of one week, when it was necessary to repeat the treatment.

TURKEYS AND POULTRY

Progress Made in Turkey Breeding

In the semi-broadbreast Bronze turkeys of the Station flock genetic improvement along several lines has been slow.

Since about twice as many young hens were kept during 1944-45, as during the preceding year, it is hard to make accurate comparisons with records of previous years. No significant improvement was shown in age of maturity, production through the first 91 days, the rate of laying, nor in reduction of broodiness, but gains were made in hatchability, egg size, and body measurements.

For hatchability, egg size, production, and body weights, 49 per cent of all hens qualified for rating as Record of Performance under the requirements of the National Turkey Improvement Plan.

Several outstanding families were developed, the best being that of Dam A230 (Fig. 50). Eight daughters from this dam were under test. No mortality nor broodiness occurred in this family, and the average production was 146 eggs, with over 80 per cent hatchability of all eggs that were incubated. The range in production in this family was from 120 to 171 eggs.

Both males and females hatched in 1945 were measured for meat qualities when around 24 weeks of age, and all extra toms of good quality were made available to turkey breeders of the state. Through this cooperation, 740 toms from outstanding families have been released to the industry in the past six years.

Strains Show Large Differences in Broiler Qualities

As the first step in a project aimed toward improvement in broiler qualities, four strains of Barred Plymouth Rocks and three strains of New Hampshires were obtained. Four cockerels and around 15 hens were used in each strain to produce chicks that were reared at the Mountain Station at Waynesville. Records were taken of the weight of individuals at 3, 6, 9 and 12 weeks of age; rate of feathering at hatching, 10 days, and six weeks; and length of shank, width of body, and depth of body at 12 weeks.

Large differences were found both within and between the strains. The best strain of New Hampshires averaged eight ounces heavier at 12 weeks than the poorest strain of the same breed, and 10 ounces heavier than the poorest strain of Rocks. For broilers fully feathered at six weeks of age the values ranged from zero to 90 per cent. About 300 pullets were retained

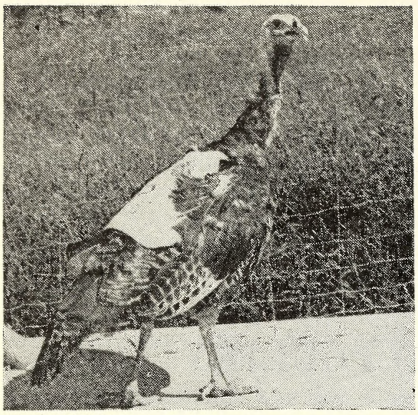


FIG. 50. A230, WHOSE EIGHT DAUGHTERS MADE AN OUTSTANDING RECORD IN PRODUCTION AND HATCHABILITY.

to obtain records of egg production, broodiness, hatchability, and other factors essential for the economical production of chicks.

The performance of these strains emphasizes that growers of broilers should use strains having superior broiler qualities. Strains bred to lay at a high rate are usually lacking in such qualities.

High Livability Maintained in Leghorns

For four years approximately 90 per cent of all pullets in lines bred for superior livability have lived through at least one year of age. Reared with these lines and thus under the same conditions, a line not selected for superior livability has averaged around 80 per cent survival. No culling has been done in these tests and all pullets were retained for at least one year.

When selection for improved livability was begun in 1938, chief causes of mortality were prolapse, avian-leukosis complex, and a general

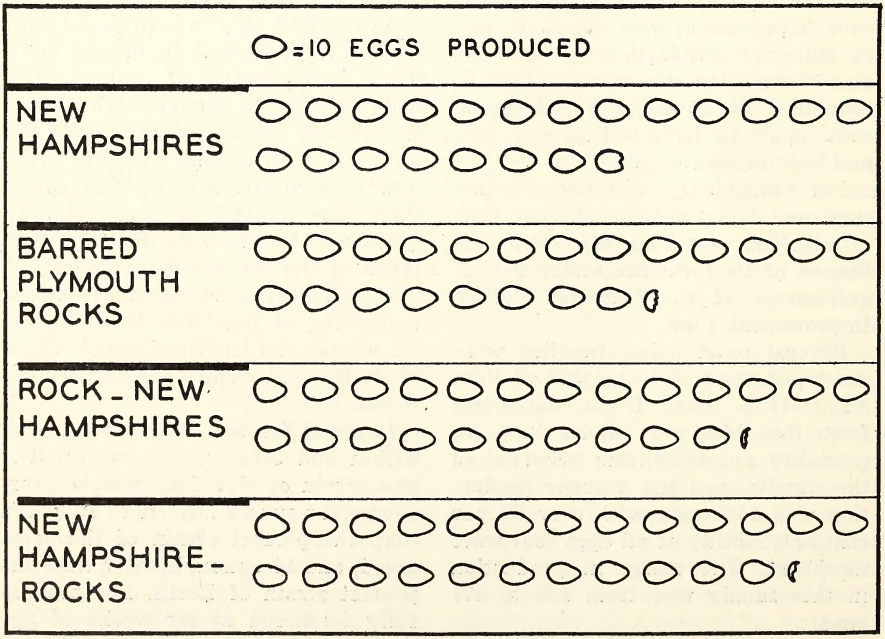


FIG. 51. FIRST YEAR'S PRODUCTION BY PULLETS HATCHED FEB. 8, 1944. A COMPARISON OF PRODUCTION BY CROSSBRED AND PUREBRED PULLETS.

devitalized condition without specific lesions. These three causes accounted for 87 per cent of all mortality. Among pullets reared in 1944, these conditions involved 23 per cent of all mortality.

A high level of livability has been developed and maintained without lowering production but with a slight decrease in egg size. Among pullets of the 1944-45 season, the average production for the first six months of laying was 110, and average egg size was approximately 24 ounces per dozen.

Before this strain is released for general distribution it is being compared with other strains, and with progeny resulting from using males of high livability line with females of unrelated strains.

Improvement in Rocks and Reds

In the Barred Plymouth Rocks and Rhode Island Reds at the Central Experiment Station and the Reds at the Lower Coastal Plain Experiment Station the principal breeding objectives have been the improvement of livability and production. Gains were made in all three groups among pullets hatched in 1944, but were most outstanding at the Lower Coastal Plain Experiment Station. From all pullets reared in 1944, 91 per cent were alive on May 1 as compared with 78 per cent for 1943. A slight drop in production for the first six months, from 122 to 116, was more than offset by a decrease in the average age to first egg from 229 to 200 days.

In the Rocks and Reds at Raleigh there was a slight drop in rate of production but some gain in livability. Among the Reds the livability increased from 86 to 91 per cent, and among the Rocks from 85 to 87 per cent.

NUTRITION

Icing of Vegetables saves Vitamin C

In the spring and summer of 1945, a study was made of the losses in vitamin C of certain vegetables from the moment they were harvested until such time as it was assumed they would have normally been bought by the consumer. Ascorbic acid (vitamin C) was chosen as the nutrient to study not only for its importance as a vitamin, but also because as a vitamin it is one of the most susceptible to destruction by adverse conditions of storage.

In each case, freshly-harvested vegetables packed in ice chests in the field were compared with the same vegetables uniced and stored at room temperature. Moisture and vitamin C analyses were made every day for six days.

The effect of icing or not icing on eight vegetables and on blueberries and strawberries may be summarized as follows:

Collards—The Herring Variety was used. The loss of vitamin C in the uniced collards amounted to 12 per cent in the first 24 hours and 30 per cent in 48 hours. After 144 hours the loss amounted to 78 per cent. There was no loss in the iced material, and there was no significant difference between the two kinds of ice used, finely-crushed "snow" ice or lumps of ice about the size of walnuts. After three or four days, the uniced collards had become yellow and spotted and after six days the spoilage was quite extreme. The iced collards retained their crispness and turgidity nicely for six days and were scarcely distinguishable from freshly-harvested collards.

Kale—The Dwarf Siberian Variety was used. After 48 hours at room temperature, it had lost 34 per cent of its vitamin C; and after four days, only 39 per cent of the original vitamin C remained. The kale had become badly wilted and yellowed by this time. The iced kale had no loss after six days' storage and retained a remarkably "fresh-look." Further, there was no difference in the results whether the icing was carried on with snow ice or ice of walnut size.

Mustard greens—The Ford Hook Variety used lost 20 per cent of its vitamin C in the first 24 hours when no ice was used. After six days this loss was 38 per cent. As might be expected, the greens were badly wilted by this time. The iced collards, whether with snow ice or ice of walnut size, retained their original vitamin C value. After six days, they were crisp and fresh but had begun to yellow slightly.

Butter beans—The Baby Ford Hook Variety used was stored by two different methods. In one case, the beans were surrounded with snow ice in the ice chest. In the other, the beans were put on a shelf near the ice but not in direct contact with it. Retention of vitamin C by both methods of icing were identical. This is one of the few cases, however, in which there was a slight loss during icing: 12.5 per cent after six days of storage. The uniced beans lost as much as 59 per cent in 72 hours at room temperature, and the bean pods looked dry and spotted by this time.

Snap beans—Snap beans of the Tendergreen Variety lost their turgid appearance after four days of storage at room temperature and suffered a loss of 20 per cent in vitamin C value. The beans that had been iced had shown no loss in either appearance or vitamin value in this time.

Bell peppers—Bell peppers of either the California Wonder Variety or the Ford Hook Variety lost no vitamin C when stored either in ice or above ice. The losses, however, were very slight even without ice; and the appearance was not as seriously affected as with many other vegetables after six days.

Cabbage—Cabbage of the Norfolk Wakefield Variety lost none of its vitamin C value after six days whether stored with ice or at room temperature. Without ice, however, the outer leaves became bleached or badly discolored.

Tomatoes—Medium ripe tomatoes of the Marglobe Variety showed no appreciable loss in vitamin C whether stored in ice, above ice, or at room temperature with no ice at all.

Blueberries — Blueberries of the Scammel Variety in standard pint boxes resting above ice were compared with berries stored at room temperature. After six days, there was no loss of vitamin C in either group, but the berries held at room temperature were shriveled and dry and, in some cases, had begun to show signs of mold spots throughout the container. The iced berries, on the other hand, were as fresh, firm and juicy-looking as they had been when picked.

Strawberries—Strawberries of the Massey Variety when stored above ice lost no vitamin C after five days of storage. The only signs of spoilage were slight soft spots, relatively few in number, on a few of the berries at the top of the containers. Without ice, the berries held their ascorbic acid (vitamin C) remarkably well until the third day, by which time they had become so moldy that they had to be discarded.

Cook Potatoes With a Pressure Saucepan

Market Irish potatoes of the New Jersey variety when cooked in a four-quart pressure saucepan for eight

minutes retained 83 per cent of their original vitamin C, the vitamin most easily destroyed by cooking. The actual destruction of vitamin C amounted to 8 per cent, and 9 per cent was dissolved by the cooking liquid.

Boiling pared Irish potatoes by regular home cookery methods results in a large variation of losses, ranging from 4 to 59 per cent, with an average of about 25 per cent. Thus the pressure cooker appears promising for home cookery, both from the standpoint of time saved in food preparation and the retention of vitamins in the cooked food.

Sweet Potato Varieties Differ in Vitamin Content

Nine varieties of sweet potatoes grown under identical conditions showed wide differences in their content of carotene (pro-vitamin A), vitamin C, and dry residue contents as determined at harvest. The varieties studied included Little Stem Jersey, Maryland Golden, Nancy Gold, Ranger, Unit 1 Porto Rico, L 132, B 2934, B 703, and L 37.

Maryland Golden, Nancy Gold, Ranger, and L 37 had high, similar carotene values, while B 2934 and Little Stem Jersey had the lowest values. Maryland Golden and Nancy Gold also surpassed the other varieties in their content of vitamin C. L 132 and B 2934 had the highest dry residue values, while Little Stem Jersey and L 37 had the lowest.

After curing the potatoes for seven days at 85° F. and a relative humidity of 75 to 85 per cent, all varieties except Ranger and B 2934 lost some vitamin C. Though Little Stem Jersey, Maryland Golden and Nancy Gold lost from one-third to one-fifth of their original vitamin C as a result of curing, they still retained their same relative positions to the other varieties as before cure, in terms of vitamin C content.

Changes in the dry residue content as a result of curing were too small to suggest a real difference between varieties.

Pastures Don't Need Frequent Reliming

Yearly observations on the yields of pasture herbage and on the percentages of nitrogen, calcium and phosphorus in the herbage show that the effects of a single application of limestone are apparent six years later.

At the beginning, plots laid out on a mixed permanent pasture sod in Haywood County were treated with all combinations of none, 64, 96 and 128 pounds phosphate, as fused rock phosphate, and none, ½, 1 and 2 tons dolomitic limestone per acre. Three years later they were rephosphated, but no additional lime was added. Each plot has been clipped at monthly intervals throughout the growing season for six years. The clippings for each year have been analyzed for nitrogen, calcium and phosphorus.

The yields have varied considerably from year to year, depending upon the amount of rain and other climatic factors. Each year, however, the limed plots have yielded consistently more than the unlimed and the phosphated more than the unphosphated plots. The greatest yield has usually been from the plots treated with 96 pounds phosphate and one ton limestone per acre. There is no evidence so far as yields are concerned that the effect of even the smallest application of limestone (½ ton per acre) is wearing off.

In those years that were favorable for large crop yields, the percentages of nitrogen, calcium and phosphorus in the herbage were higher than in the clippings grown in less favorable years. After making an allowance for this variation, there has been a steady decline in the amount of calcium in the herbage from the untreated con-

trol plots from about 0.85 per cent to about 0.55 per cent. The protein in these clippings has dropped from nearly 14.5 per cent to about 13 per cent, and the percentage phosphorus has fallen off slightly during the six years.

This tendency of the unfertilized plots to produce nutritively poorer herbage each succeeding year has not been found on the limed or phosphated plots. In fact, each year the effect of lime has been to increase the total yields and the percentage of nitrogen and calcium over that in the controls. The percentage of phosphorus has not been affected to any great extent by the liming.

At the end of six years, neither the total yields of monthly clippings nor the percentages of nitrogen, calcium, or phosphorus in these clippings offer any evidence that the effect of an application of limestone to this pasture is wearing off.

Fertilization Makes More Nutritious Lespedeza Hay

In the last Annual Report was a statement that fertilization has no effect on the amounts of nitrogen, calcium, or phosphorus in lespedeza in a dry year when the plants made very little growth, but that "it is probable that the lack of moisture prevented the plants on the fertilized plots from utilizing their extra supply of nutrients and in a more normal season there may be a difference in the nutritive value of lespedeza grown on fertilized and unfertilized land."

In a later experiment, it has been found that, on a badly eroded and rather infertile field, liming alone nearly doubled the yield of lespedeza hay. Phosphates alone tripled the yield and both lime and phosphates together gave a six-fold increase in the yield of hay.

The percentage of nitrogen in the hay from the limed or phosphated plots was only slightly greater than that in the hay from the unfertilized plots, but the lespedeza from the plots getting both lime and phosphate contained one and one-half times as large a percentage of nitrogen. Liming alone had little effect on the percentage of phosphorus in the hay, but phosphates alone or with lime produced a hay materially richer in this element. The calcium content of the hay was increased only slightly by the fertilization.

Raw Soybeans as a Source of Protein for Growing Pigs

Thirty- to forty-pound pigs receiving a ration composed entirely of ground raw soybeans supplemented with vitamin A and a complete mineral mixture made gains of 0.88 pound per pig per day when fed to a weight of 100 pounds. These gains are nearly normal. Addition of 0.3 per cent cystine or vitamins of the B-complex to this ration did not improve the gains.

When 50 per cent of the soybeans were replaced with starch, the average daily gain per pig was reduced to 0.50 pound. Addition of 0.3 per cent cystine in this last ration, however, increased the gain to 0.75 pound per day, while addition of a combination of vitamins of the B-complex (thiamine, riboflavin, nicotinic acid, pyridoxine, and pantothenic acid) produced gains of 0.70 pound per day. When the ration was supplemented with both cystine and vitamins of the B-complex, the gain averaged 0.80 pound per pig per day, and the feed consumed per 100 pounds of gain decreased from 405 to 317 pounds.

It is evident that for young pigs fed for a gain of 60 pounds, raw soybeans when making up half of the ration are not adequate nutritionally since greater growth is obtained when either cystine (or available methionine) or the vitamin B-complex, or both of these are added to the ration.

SOCIAL and ECONOMIC PROBLEMS

SOCIAL PROBLEMS

Rural Health Services Need Improving

The process of improving health services in North Carolina is to a large degree a rural problem because: (1) Nearly three-fourths of the population is rural, and because of (2) the shortage of facilities and personnel available to rural people.

The medical care service sought by rural people is not of a special type, but what they need and want is a program that will allow them full participation in the benefits offered at the highest level of medical science. This is the same type of service desired by people in urban centers.

A list of some types of additional personnel and facilities needed will serve to indicate the seriousness of the problem:

(1) The primary need is for well trained general practitioners, geograhically and financially available to all rural people; also specialists should be similarly accessible. Before the war, North Carolina had 2,300 active physicians, but 3,600 were needed to provide at least one doctor for each 1,000 people. The additional 1,300 doctors are needed in rural areas or in positions to serve rural people.

(2) In 1940, North Carolina had one dentist for each 4,544 people. This means that about 1,000 additional dentists are needed to give the state at least one dentist for each 2,000 people. If the standard is set at one dentist for each 1,000 people, then about 3,600 dentists are needed. In either case, the bulk of additional dental personnel needed should be so located as to serve the rural population.

(3) About 6,000 additional hospital beds are needed to bring the state average up to four beds per 1,000 population. It would take an additional 1,600 beds to bring the average to 4.5 beds which is often recommended as a standard. A large proportion of additional facilities are needed in rural areas or, at least, should be located so as to serve rural people more adequately.

An analysis of the death rates in the state as compared with rates in other states will perhaps point up an answer to the question of what are the consequences of this lack of medical service. Listing as preventable those deaths which would not have occurred if the death rates by age in North Carolina had been as low as

those in any other state's major residential group (rural or urban), more than half (52.2 per cent) of the deaths in the state in 1940 should not have occurred in that year (Fig. 52). There would have been 44 per cent fewer deaths in the white population and 66.3 per cent less nonwhite deaths. The following summary should be carefully studied:

	Deaths, 1940	Preventable deaths, 1940
Total	31,904	16,642
Rural	21,924	10,697
Urban	9,980	5,945

These results were obtained by using the low rates which have been attained already in some states. There appears to be no feasible reason why North Carolina cannot have rates as

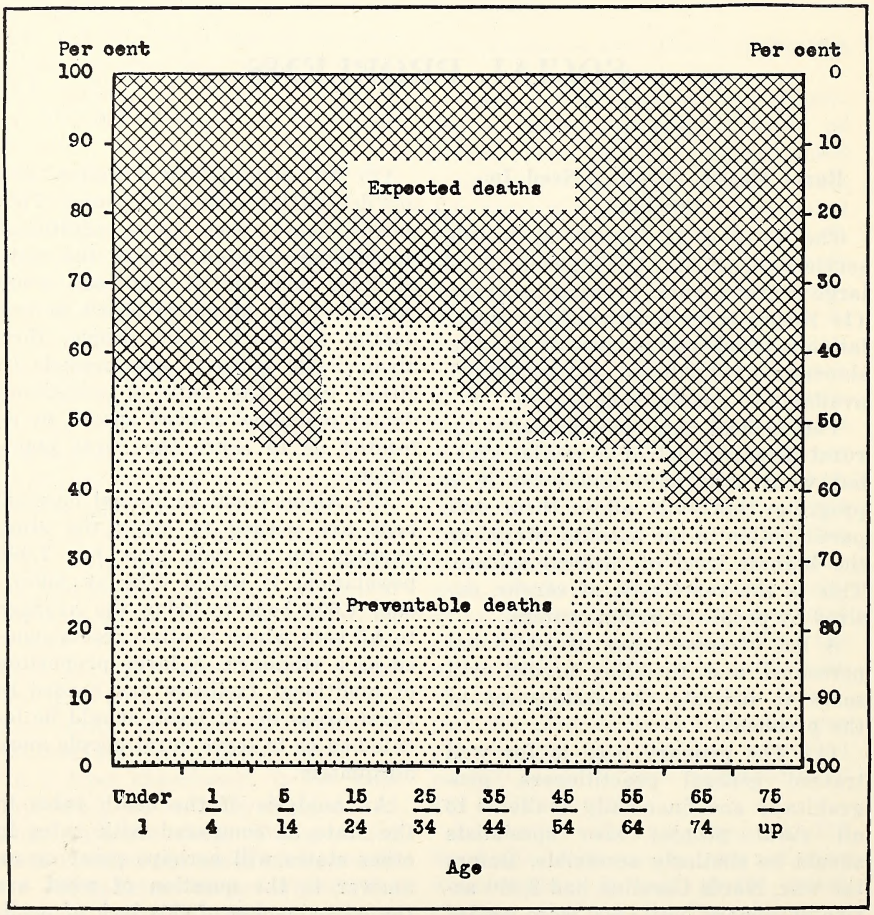


FIG. 52. PERCENTAGE DISTRIBUTION OF PREVENTABLE DEATHS IN THE RURAL POPULATION BY AGE, NORTH CAROLINA, 1940. THE 100 PER CENT REFERS TO ALL DEATHS THAT OCCURRED IN 1940. EXPECTED DEATHS ARE THOSE THAT WOULD HAVE OCCURRED AND PREVENTABLE DEATHS ARE THOSE THAT WOULD NOT HAVE OCCURRED IF NORTH CAROLINA HAD HAD DEATH RATES COMPARABLE TO THE LOWEST IN THE NATION IN 1940.

low or lower, provided an adequate medical care program is developed.

Therefore, a complete medical care system in North Carolina should insure that: (1) Every person receives instruction in individual and community health problems; (2) adequate facilities and personnel are available; and (3) an equitable method of paying for needed services exists.

Education for Rural People is Inadequate

Education and living standards are very closely related. Education is as necessary for farmers as it is for persons in any other occupation—if they are to use the best scientific methods, and these methods must be used if the living standards on farms are to keep up with those in other occupations.

College trained men and women are recognized as valuable assets in our society. Yet, rural areas and especially farms in North Carolina have little drawing-power for persons with college training. In 1940, 24,889 persons 25 years old and over who were living on farms in North Carolina had completed one or more years in college. Unfortunately, however, only 8,123 of these had completed four or more years.

This means that only 3.6 per cent of all persons on farms who are 25 years old or over have completed one or more years in college. Compared with the 16.4 per cent in urban centers and 10.4 per cent in rural-nonfarm areas, this percentage is extremely low. Of this number, only 1.2 per cent of the adult farm population has completed four or more years in college. Compare this with the 7.4 per cent in urban centers and 4.6 per cent of the rural-nonfarm population.

The situation is improving. This is shown by the fact that a larger proportion of the farm men and women in the younger age groups have received some college training. For example, only 22 persons in each 1,000 in the age class 65-69 have at least one year of college training, but the corresponding proportion for the age class 30-34 is 47 in each 1,000.

The other end of the educational scale is very important also, because a large number of illiterate or near illiterate people will not contribute to a rapid advance in levels of living.

In 1940 there were 143,563 functionally illiterate (persons having completed less than four grades in school) adult persons (persons 25 years old or over) on farms in North Carolina. This number represents 20.9 per cent of the adult rural-farm population. This is very high as compared with only 12.8 per cent in urban centers.

However, the proportion of functionally illiterates in the state is higher than that for the nation in all residence classes. In fact, North Carolina has 4.6 per cent of the total adult farm population of the nation, but it has 7.5 per cent of the functionally illiterates.

The situation is improving. For example, only 116 of each 1,000 persons in the age class 25-29 dropped out of school before completing the fourth grade as compared with 245 of those 50-54 years of age. This condition makes imperative the more careful preparation of educational materials designed for the rural population.

The preceding discussion concerning the education of adults gives rise to the necessity of studying the rural population with respect to current school problems. Two such problems are analyzed below.

When the last Census was taken, one out of each three children 8-16 years of age attending school was retarded, that is, failed to pass. Retardation is an even more serious

problem in rural areas and especially among rural-farm youths. This is shown by the fact that 38.2 per cent of the children on farms are retarded. A much larger proportion of the boys than girls are retarded. It should be noted that more than half of the rural-farm boys 12, 13, 14, and 15 years of age are retarded (Fig.53). The best information available indicates that this situation has not improved materially since the Census was taken.

The retardation picture presented above does not take into account those boys and girls who are not attending

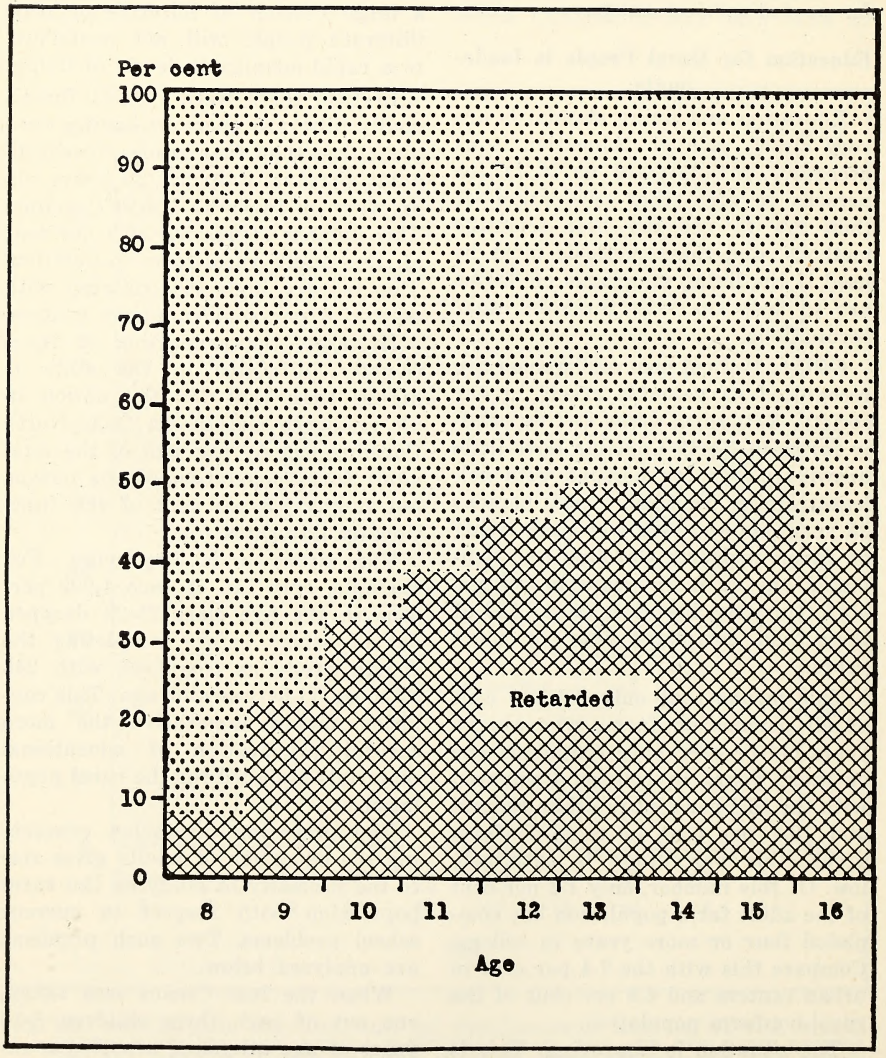


FIG. 53. PERCENTAGE DISTRIBUTION OF THE RURAL-FARM POPULATION, 8-16 YEARS OF AGE ATTENDING SCHOOL, SHOWING THE PROPORTION RETARDED, NORTH CAROLINA, 1940.

or even enrolled in school. A larger proportion of the rural-farm youths (8-16 years of age) are out of school than are those in other residence classes. In fact, 12 of each 100 farm boys and girls are not being touched by our school system. It should be carefully noted that age 13 is a very critical stage in the school life of our youths. The proportion of youths out of school at 13 is about as large again as that at 12 years and, unfortunately, this situation continues through age 16. At this age, 40 per cent of all the boys in North Carolina are out of school.

ECONOMIC PROBLEMS

Planned Production Was Successful

Can a state plan for agricultural production? This was an important question during the war when the nation had to have definite amounts of specific farm products. At the request of the Federal government, the North Carolina Agricultural Experiment Station in cooperation with the Extension Service undertook the task of planning the agriculture of the state. The success of this venture proves that planning at the state level is feasible, and the experiences acquired should be useful in the postwar era if the economy of the state gets out of line with the economy of the nation as a whole.

The effectiveness of planning during the war may be measured by comparing the official goals with the actual production for principal crops and livestock for the three war years —1943, 1944, and 1945. This comparison is shown in Figure 54 where the production of the major crops and the number of livestock are expressed as percentages of the official goal. In no year did the reported acreages of corn, tobacco, small grains, or the number of cows, hens and pullets fall more than 10 per cent under or go more than 10 per cent over the official goals. The production of cotton was under the goal each year, varying as much as 30 per cent below the goal in 1945. The production of peanuts picked and threshed was within 13 per cent of the official goal for each year except 1943 when the production reported was much lower than the official goal. The production of soybeans for beans was much below the goal in both 1943 and 1944 but close to the goal in 1945. The production of Irish potatoes was considerably above the goal in 1943 but fairly close in the other two years. The production of sweet potatoes was considerably below the goal in both 1944 and 1945. Sows farrowed were reasonably close to the goal in 1943 and in the spring of 1944. In the fall of 1944 and all of 1945 the actual number farrowed were much below the goal.

Growth of Cooperatives

From a few isolated cooperatives, which were in operation in North Carolina in 1929, there are now over 40 commercial cooperatives, a number of financial, mutual fire and life insurance associations, and several noncommercial associations, all of which are rendering farmers valuable service. To determine the present status of the cooperative movement in this state, a study was undertaken in 1945. For several reasons it was not possible to obtain adequate information from all active cooperatives, but sufficient data were collected to provide a clear notion of the present size of the movement and how it is serving the farmers of the state.

Commercial Cooperatives. There were

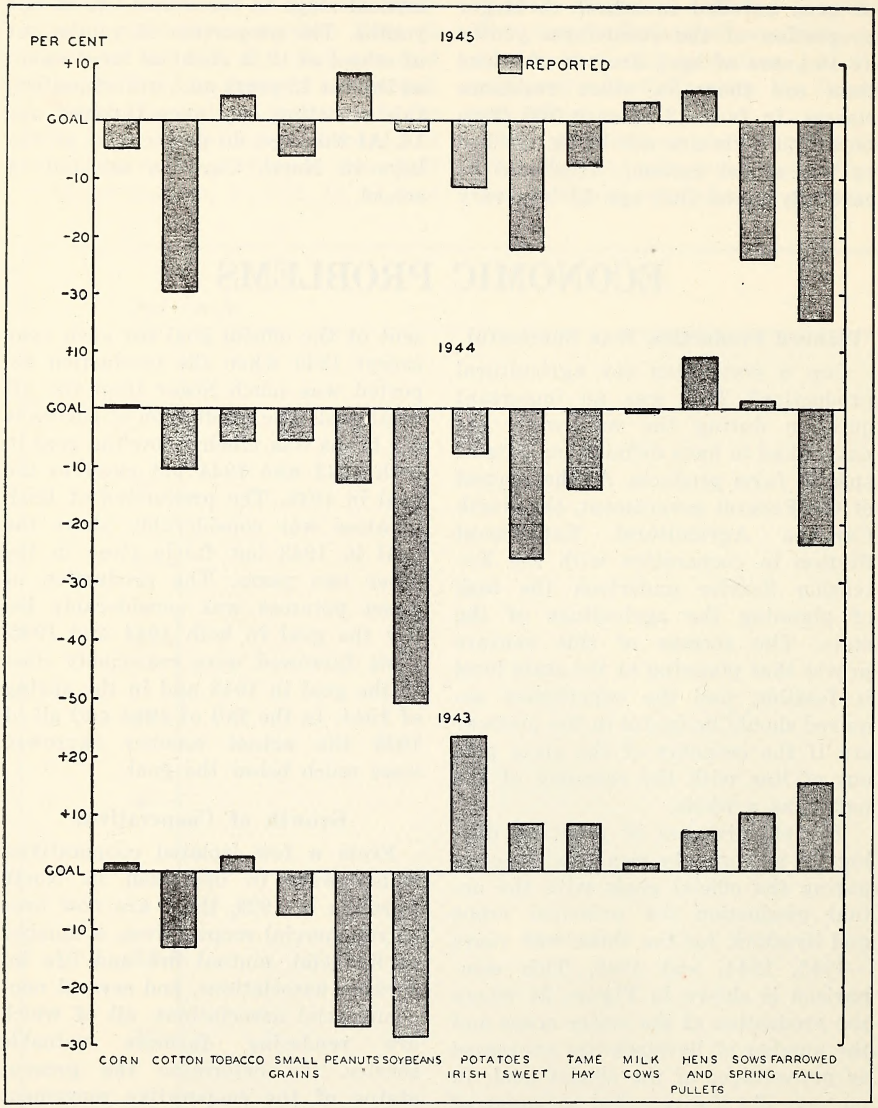


FIG. 54. PRODUCTION OF IMPORTANT CROPS AND LIVESTOCK COMPARED WITH THE OFFICIAL STATE GOALS—1943-1945. (GOAL = 100%.)

about 35 cooperatives operating in the state in 1944 that were engaged in buying or selling activities. Twenty-one of these, from which reports were obtained, made sales of $34,361,258. Their purchases were $31,144,256, leaving an operating margin of $3,217,002. Most of these coooperatives received other income of $836,718, hence their total income was $4,053,720. Operating expenses were $2,706,861, leaving a net income of $1,346,859.

The membership of these 21 cooperatives was 63,296 persons.

Financial and Insurance Associations. In 1933 the Congress of the United States passed an act which made possible the organization, financing, and operation of associations specifically designed to serve farmers. These associations are designed to supply production credit to farmers at a cost which is in line with that obtained by users of commercial credit. As of January 1, 1944, there were 27 of these associations operating in the state and during the preceding year they made 10,454 loans to farmers.

Credit unions were much more important in 1920 than they are today. Originally these served mostly white farmers—they are now used largely to supply credit to Negro farmers. In 1944 there were 18 unions in operation which made loans amounting to $69,215.

There were ten farmers' mutual fire insurance associations operating in the state in 1943. For the year ending December 31, 1943, these associations reported premiums amounting to $235,036. Their losses during this period were $131,692. These associations were apparently in a sound financial condition since their net worth was $688,682. In addition to these associations, the Farm Bureau Mutual is also operating in the state, with premiums amounting to $825,582, losses of $300,335, and a net worth of $775,000.

Non-Commercial. Beginning in 1943 soil terracing units were organized. Up until November 1941, when terracing operations were discontinued because of the war effort, these units had made a remarkable record. The associations built 16,497 miles of terrace on 233,204 acres of land at a cost of $2.03 per acre. The use of lime and phosphate is being promoted by associations operating in 15 of the western counties of the state.

There were 28 electric membership cooperatives in the state July 1, 1944. Largely as a result of the rural electrification program of the cooperatives and private utility companies, North Carolina now has 28,879 miles of line serving 157,580 customers. In addition, these associations have advanced funds for the purchase of electric equipment amounting to $15,959,396.

In 1940 there were 90 cooperative associations serving Farm Security clients. These cooperatives, however, were largely abandoned as only two were in operation in 1945. The Farm Security Administration has encouraged and fostered group services that cannot be obtained by individuals. These services include practically every important service which a modern farmer needs, such as sire services, machinery services, and miscellaneous services. These services have been supplied to 13,022 clients through loans amounting to $396,544.

The Effect of Industrialization on Farming

Much thought and attention are being given to the effect of industrial development and activity on agriculture. It has been said that more industrialization means greater per capita farm income.

To determine to what extent, if at all, this statement is true, a study was undertaken in 1943 of 128 farms near centers of industrial activities in the Piedmont section of North Carolina. These farms varied from those which obtained no off-the-farm income to farms which obtained the major part of their income from members of the farm family working in nearby industrial plants.

Over-all income of the farm family rose as off-the-farm work increased, but as the income from industrial employment rose income from farming declined. Of the 128 farms, there were 60 that did not receive any outside income. The labor-management wage for these farms averaged $239. There were 35 farms which used up to 34 per cent of its available labor in industrial employment. For these the average labor-management wage from the farm was $169, but the non-farm income was $1,110, or a total of $1,279. Where the off-the-farm work was greater than 34 per cent, the average labor-management wage was minus $312—the off-the-farm work, $2,176 or a total of $1,864.

A highly significant relationship was found between land use and off-the-farm work. The acreages of both cultivated cropland and row crops were unaffected by non-farm work, but the acreage in soil-conserving crops was significantly reduced as off-the-farm work increased.

It may be concluded that the income of full-time farmers is not materially affected by industrial activity. But for those farms which possess a surplus of labor the family income may be increased markedly by off-the-farm work. The effect of this off-the-farm work, however, is to impair or deplete the soil, since the use of soil conserving crops is reduced.

Farm Mechanization in the Central Piedmont Slow

As the second in a series of studies on the extent to which North Carolina farmers are mechanizing their farms, a survey was made in the Central Piedmont. With few exceptions, this section has the highest concentration of tractors of any other area of the state. In Rowan and Stanly counties, about 45 per cent of the active farm units have tractors. However, the amount of complementary tractor equipment is small.

One of the major problems of mechanization is the small amount of annual use of tractors and complementary equipment. The average tractor was used only 400 hours per year, 150 hours or 34 per cent of which were spent at custom work on neighboring farms. Fifty-five per cent of the tractors were used less than 450 hours, and only 12 per cent were used 750 hours or more. Important things which contribute to the low amount of annual use are small size of farm, low proportion of row crops, and absence of equipment to be used with the tractor.

Partial mechanization is another factor affecting the progress of mechanization. This is particularly true of row crops. In the main, mechanized equipment is used for seedbed preparation, but the planting, production, and harvesting are done with horse equipment or hand tools. In the case of a crop such as cotton, the maximum labor requirement is at the harvest period. If the farmer cannot hire extra labor at this period he is forced, because of partial mechanization, to carry a surplus of labor throughout the year to meet his harvest need. If complete, rather than partial, mechanization were possible for all crops, the trend towards mechanization of the farms in this area would be rapid; but, inasmuch as this does not appear possible, further mechanization of the farms must wait until new mechanical devices are made available.

Value of Farm Resources Has Increased

A great deal of money and labor has been spent by state and Federal governments to improve the agriculture of the state. Has this objec-

tive been attained and if so, to what extent?

To find at least a partial answer to this question a study of the farm resources of the state was undertaken in 1944. The period chosen was from 1910 to 1940, inclusive. It was assumed that if the net farm resources had changed to any great extent over this period it would indicate progress or decadency. The resources studied were land, buildings, machinery and equipment, and livestock.

These farm resources were valued at $535,000,000 in 1910 and $872,000,000 in 1940 (Fig. 55). There was a gain, therefore, over this period of $337,000,000. But this was not a net

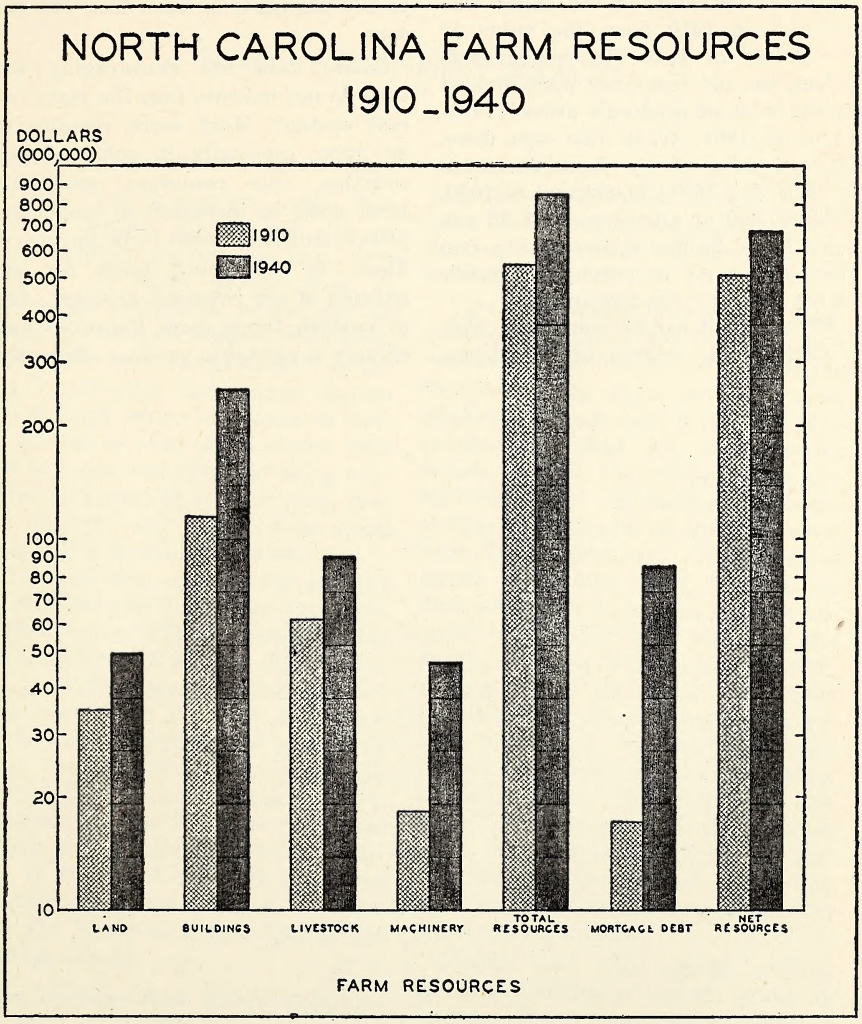


FIG. 55. FARM RESOURCES BY SPECIFIED CLASSES EXPRESSED IN CURRENT VALUES, MORTGAGE DEBT, AND NET RESOURCES IN PURCHASING POWER FOR 1910 AND 1940.

gain since these resources were, to some extent, mortgaged. If, therefore, the mortgage indebtedness of $17,000,000 be deducted from the gross value in 1910 and also the mortgage indebtedness of $85,000,000 in 1940, the net assets in these years were $518,000,000 and $787,000,000, respectively, or a gain of 52 per cent.

These data are apt to be misleading since the value of the dollar was different in 1910 from the value of the dollar in 1940. To correct this defect, the net resources were divided by the index of wholesale prices (1910-14 equal 100). When this was done, the net value of our farm resources in 1910 was $503,000,000 and in 1940, $685,000,000 or an increase of 36 per cent. These figures represent the real change in value or purchasing power of the farmers' net resources.

From this it can be concluded, with a considerable degree of confidence, that farmers have made some progress in accumulating net resources. But there are, however, some dark spots in our agricultural economy. There are 13 counties in the state which show a decline in net resources during the period under discussion. Thirty counties made gains varying from 1 to 25 per cent; 29, from 26 to 50 per cent; 19, from 51 to 75 per cent; 7, from 76 to 100 per cent; 2, more than 100 per cent.

These data are encouraging but they do not indicate that the state can rest content. Much work remains to be done, especially in some of our counties. Our resources, especially land, must be increased in productive power. Buildings need to be improved. There is still much room for expansion of our livestock industry. And in modern times more improved machinery is needed to produce efficiently.

SOILS and FERTILIZERS

SOIL CONSERVATION

Corn-Kudzu Rotation Reclaims Land

Kudzu has heretofore been considered suitable mainly for use as supplementary pasture or hay, particularly on badly eroded land. It now seems practicable to use also as a legume crop in a rotation with corn.

This has been demonstrated at the Soil Conservation Experiment Station near Raleigh where two acres of kudzu, planted in 1941 on an eroded field of 5 to 8 per cent slope, is being converted to a rotated contour strip system of corn and kudzu with small grain if it is found practicable.

The first strip of corn was planted in 1945. The kudzu land was first disked then turned with a two-horse plow and followed by a later disking before corn was planted. Two cultivations were given the corn. Following the last cultivation, a new growth of kudzu from residual crowns rapidly covered the ground surface and by mid-summer had formed a dense growth with complete ground coverage. A 60-bushel yield of corn was harvested. Figures 56 and 57 show both the kudzu and corn during the growing season.

Slope Change—Row Grade Relationship

In working out ways of getting good row drainage with moderate row grade and planning row systems for tobacco fields at the Soil Conservation Experiment Station, slope changes have been found to have a definite effect on the grade of the rows laid out between terraces.

This relationship is shown in Table 6 which summarizes theoretical calculations made in the study. From assumed contour lines, terraces were projected so as to have 0, 3- and 6-inch grades, with both 300- and 600-foot terace lengths. Elevations within the intervals were determined by interpolation, and grades of alternate rows were then calculated. The assumed slopes were such that the terrace drained from a 3 per cent slope at the crest to a 6 per cent slope at the outlet, resulting from an interval narrowing toward the outlet. Rows then paralleled the upper terrace. The results show that even with the level terrace the second row has a definite grade and that the grades of the other rows increase with the distance from the base terrace until the row was run into the channel below. The row grades then decreased as the point rows shortened.

Notice that this grade pattern exists regardless of terrace grade or length. These row grades between contour terraces represent the effect of slope change, and this slope effect is also present with the 3- and 6-inch terraces. For example: The grade of

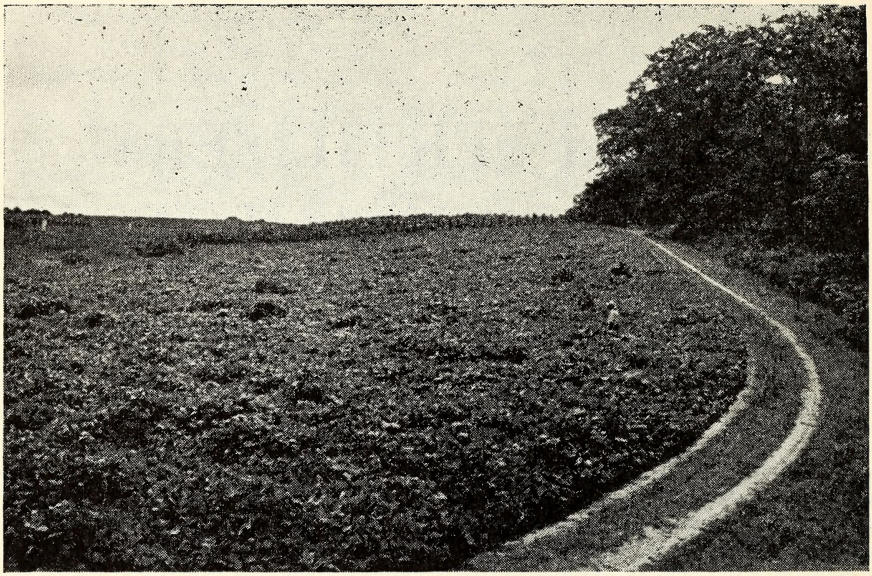


FIG. 56. A FOUR-YEAR-OLD GROWTH OF KUDZU ON AN ERODED HILLSIDE WITH CORN FOLLOWING KUDZU IN THE BACKGROUND. A 3-YEAR CORN-KUDZU ROTATION IS BEING FOLLOWED ON THIS FIELD.

FIG. 57. A VIGOROUS GROWTH OF CORN ON AN ERODED FIELD WHICH HAD BEEN IN KUDZU FOR FOUR YEARS. AFTER THE LAST CULTIVATION OF THE CORN, GROWTH FROM RESIDUAL KUDZU CROWNS QUICKLY COVERED THE GROUND.

the 14th row of the 300-foot contour terrace interval was found to be 6 inches per 100 feet. The corresponding rows of the 3- and 6-inch grade terraces were 9 and 12 inches, respectively. Thus it is seen that the row grades in each of the intervals is equivalent to the grade of the terrace plus the effect of slope change.

It was found further that the effect of the slope change in the 300-foot intervals was double that in the 600-foot interval. This means that slope change effect increases in proportion to the rate with which the slope changes. This slope-row grade relationship shows that on cropland of irregular topography slope change causes a corresponding change in row grade, which increases with the distance from the base terrace. On uniform slopes, however, where terraces tend to run parallel, crop rows would have little if any more grade than that given the terraces.

Experimental results, as well as observation and experience, indicate that approximately 6 inches per 100 feet is the most desirable grade for tobacco rows, from the standpoint of both drainage and erosion control. These facts support the suggestion that terraces on tobacco fields of uniform topography might be given a maximum gradient of 6 inches per 100 feet, while on very irregular slopes terrace grades should be held as low as practicable.

Row Grades Found With String Method Layout

The importance of continuous but moderate row grades for tobacco prompted a survey to determine the grades that occurred in an actual field layout where the string method was used.

TABLE 6.

Theoretical grades of alternate rows for differenct terrace grades and lengths.

ROW NO.	TERRACE 300 FT. INTERVAL			TERRACE 600 FT. INTERVAL			REMARKS
	Contour	3" Grade	6" Grade	Contour	3" Grade	6" Grade	
	inches	inches	inches	inches	inches	inches	2nd row below upper terrace
2	1.08	3.96	6.96	.48	3.48	6.48	
4	2.04	5.04	7.92	.96	4.08	7.08	
6	3.00	5.88	8.88	1.44	4.44	7.56	
8	3.96	6.96	9.84	1.92	4.92	8.04	
10	4.92	7.80	11.04	2.40	5.52	8.52	
12	5.88	8.76	11.64	2.88	6.00	9.00	
14	6.00	9.12	12.00	3.12	6.00	9.24	Last long row of interval.
16	5.64	8.52	11.28	3.24	5.88	8.88	Longest point row.
18	5.04	7.56	10.08	3.24	5.64	8.40	
20	4.56	6.72	8.88	3.12	5.28	7.80	
22	4.32	6.00	8.04	2.64	4.56	7.08	Shortest point row.
Interval Average	4.08	6.96	9.72	2.16	4.80	8.04	

Four terrace intervals, laid out in duplicate, or grades of 3, 6, 9 and 12 inches per 100 feet, respectively, were surveyed and the resulting row grades summarized by grade groups. Figure 58 shows the results of this survey. Notice that with a 3-inch terrace, two-thirds of the total row length had less than 12-inch grade, and that with the 6-inch terrace about one- half of the rows had less than 12-inch grades.

As the terrace grade increased, the row length tended to shift to higher grade groups. The average row grade of the different intervals (Fig. 59) was shown to be approximately six inches more than the accompanying terrace grade. This 6-inch per 100 feet was the result of slope change.

Based on the results of the row grade experiment, adequate row drainage should be expected in the intervals above both the 3-inch and 6-inch terraces. Soil loss at the same time should be reduced to a minimum, considering the type of tillage practice followed. This assumption is borne out by observations of the row system in these intervals during the past four years. Row drainage has been excellent and there has been little evidence of excessive velocity or soil movement.

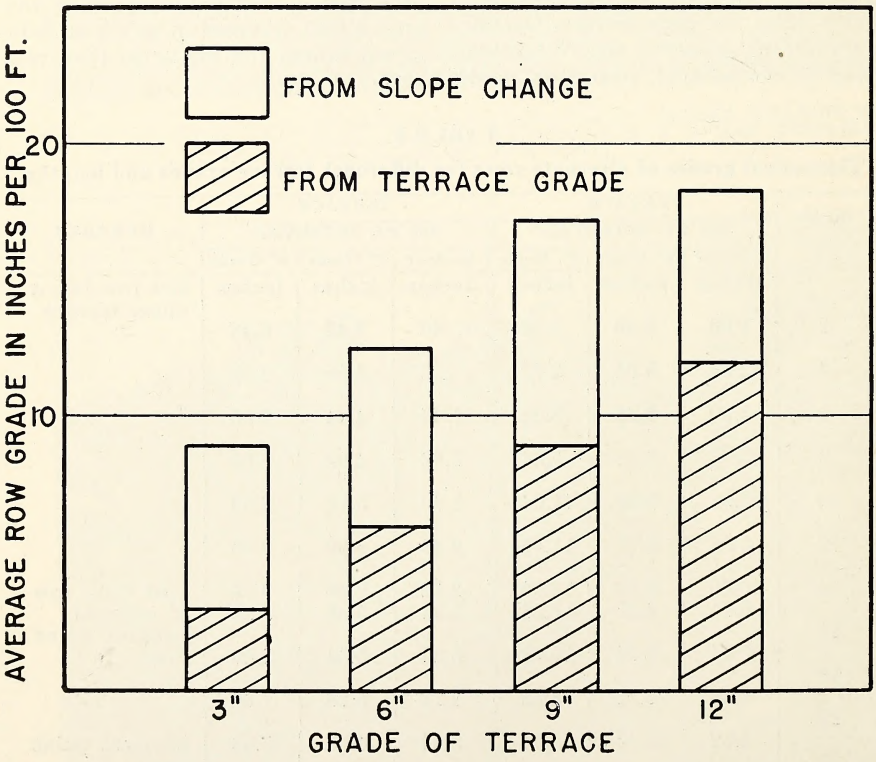


FIG. 58. AVERAGE GRADE OF TOBACCO ROWS IN THE INTERVAL ABOVE DIFFERENT GRADE TERRACES. GRADE ON THE ROWS IS CAUSED BY THE GRADE OF THE TERRACE PLUS THE EFFECT OF SLOPE CHANGE, WHEN LAID OUT BY THE "STRING METHOD."

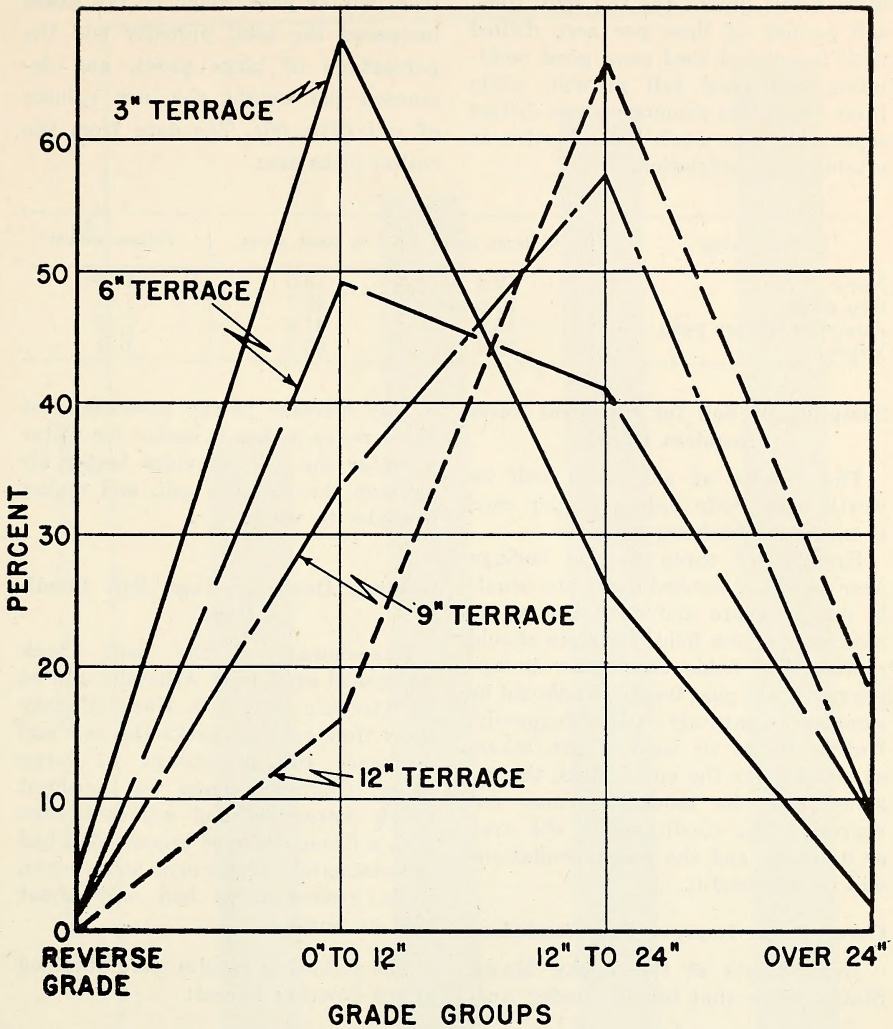


FIG. 59. ROW GRADES WITHIN THE INTERVAL ABOVE TERRACES OF DIFFERENT GRADES, SHOWN AS PERCENTAGES OF THE TOTAL ROW LENGTH FOR EACH GRADE GROUP.

SOILS

Lime Drilled With Seed Aided Nodulation of Winter Legumes

When winter legumes are planted on soils where they have not been grown previously, failures often occur due to poor nodulation even where commercial inoculants have been used. In a preliminary experiment on two Norfolk soils where winter legumes

were being grown for the first time, 450 pounds of lime per acre drilled with inoculated seed gave good nodulation and good fall growth, while three times this amount of lime drilled separately was much less effective in establishing nodulation.

trian winter peas, vetch or rye grass increased the total porosity and the percentage of large pores, and decreased the weight per unit volume of soil (Fig. 60). The data from the cotton plots are:

Preceding crop	% large pores	% total pores	Volume weight
None	12.4	38.5	1.49
Rye grass	17.6	42.7	1.41
Austrian winter peas	16.4	41.8	1.45
Vetch	18.4	43.3	1.41

Sampling of Soil for Chemical Tests Requires Care

The results of soil tests will be worth very little unless proper care is taken in obtaining samples.

Samples of three to five borings over a field of several acres are usually not adequate and do not serve to characterize the field. Farmers should realize that fields that differ in appearance and past treatment should be sampled separately and adequately. Unless 10 to 30 borings are taken, so as to cover the entire field, the results from the laboratory may not represent the conditions in the area as a whole, and the recommendations will be less useful.

Cover Crops Improve Soil Conditions

Experiments at the Rocky Mount Station show that turning under Aus-

This increase in the percentage of large pores makes it easier for water to enter the soil, provides better air passage through the soil, and makes it easier to work.

Grazing Destroys Good Soil Conditions

Experiments at the Bent Creek watershed area near Asheville and at the Coweeta Forest in Macon County show that grazing packs the soil and decreases the percentage of large pores. Ungrazed areas on the Bent Creek watershed and adjacent sites with a dense cover of broomsedge had approximately 12 per cent large pores, while grazed areas had only about half as much.

The following results were obtained at the Coweeta Forest:

Condition	% large pores	% total pores	Volume weight
1. Grazed area in wood trampled, surface bare	14.3	60.9	1.04
2. Ungrazed area in woods. Heavy litter on surface, but removed for sampling	31.5	65.1	.88
3. Grazed area in pasture. Bare	17.4	53.7	1.19
4. Corn field. Colluvial fill, weeds	34.3	66.7	.91
5. Corn field, eroded slope. Bare	19.5	57.2	1.12

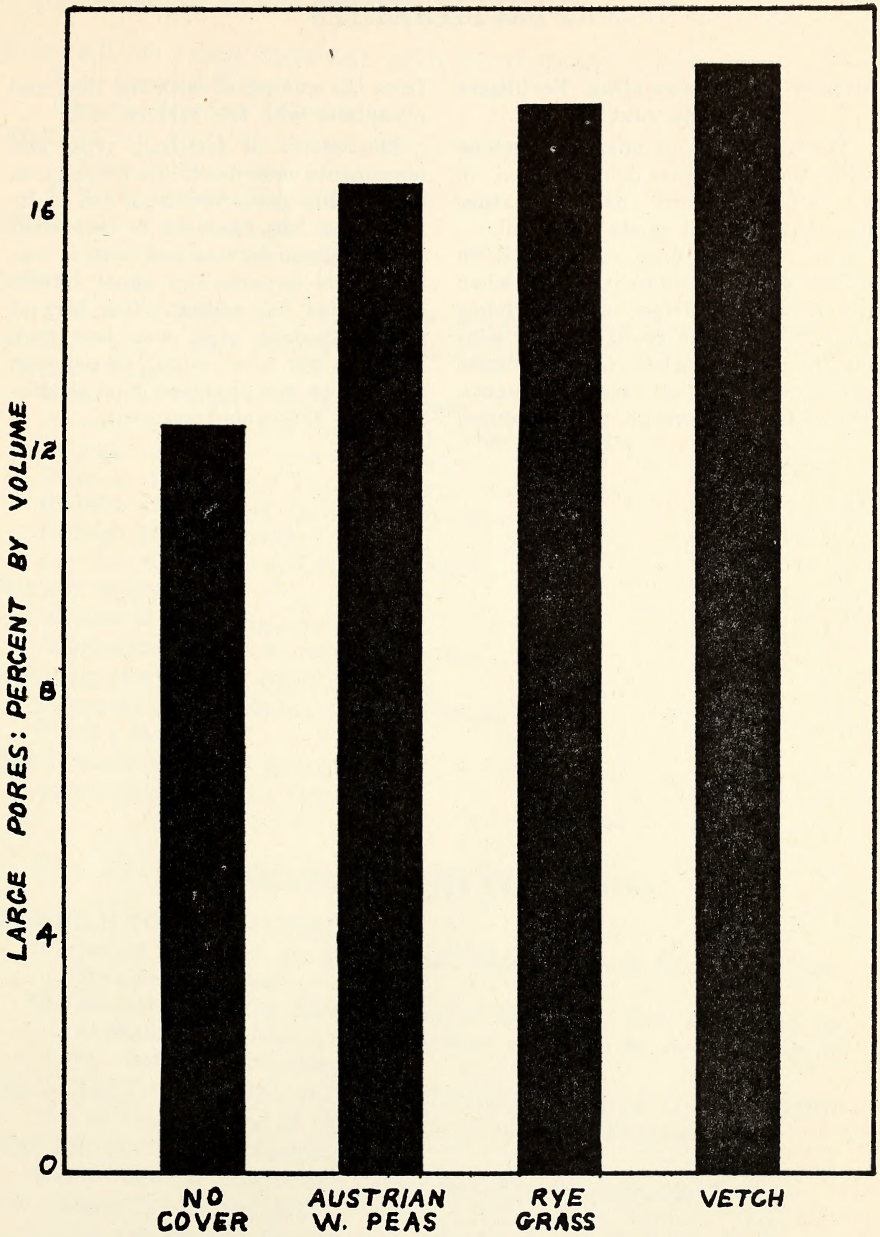


FIG. 60. COVER CROPS INCREASE THE PERCENTAGE OF LARGE PORES AND IMPROVE DRAINAGE AND AERATION OF SOILS. NORFOLK FINE SANDY LOAM AT THE UPPER COASTAL PLAIN STATION.

FERTILIZERS

Method of Incorporating Fertilizers Important

The advantage of mixing limestone with the soil was demonstrated in an alfalfa-orchard grass mixture grown on a Cecil sandy loam soil.

The yield the first year was 5,000 pounds as compared to only 2,824 when the lime was surface applied. Some gain in yield was realized from mixing the phosphate but not to the same extent as for the lime treatments. Three tons of forage was produced from the mixing of both the lime and phosphate with the surface soil.

The effects of fertilizer rates and placements were much less pronounced on a Dallis grass-lespedeza sod in its first year. The response to treatment was so slight on this soil until it was impossible to see any great effects of method of adding. The largest grass-lespedeza yield was less than two tons per acre or only 60 per cent as much as was produced from alfalfa-grass on the same treatment.

COOPERATION WITH THE UNITED STATES DEPARTMENT OF AGRICULTURE AND OTHER FEDERAL AGENCIES

BUREAU OF AGRICULTURAL AND INDUSTRIAL CHEMISTRY
- Food Research Division
- Regional Research Laboratories

BUREAU OF AGRICULTURAL ECONOMICS
- Division of Agricultural Statistics
- Division of Farm Management and Costs

BUREAU OF ANIMAL INDUSTRY
- Animal Husbandry Division

BUREAU OF DAIRY INDUSTRY
- Division of Dairy Cattle Breeding, Feeding, and Management

BUREAU OF PLANT INDUSTRY, SOILS AND AGRICULTURAL ENGINEERING
- Division of Cereal Crops and Diseases
- Division of Cotton and Other Fiber Crops and Diseases
- Division of Forage Crops and Diseases
- Division of Fruit and Vegetable Crops and Diseases
- Division of Soils and Fertilizer Investigations
- Division of Soil Survey
- Division of Tobacco and Plant Nutrition

FOREST SERVICE
- Division of Range Research
- Appalachian Forest Experiment Station

SOIL CONSERVATION SERVICE
- Conservation Experiment Stations Division
- Nursery Division

TENNESSEE VALLEY AUTHORITY
- Agricultural Relations Department

COOPERATION WITH INDUSTRIES

AMERICAN POTASH INSTITUTE
- "Placement of Potash for Peanuts and Rate of Potash Studies on Three Soybean Varieties."
- "Investigations on the Boron Content of the Major Soil Types and Its Availability to Plants, and Response of Plants to Added Boron in the State of North Carolina."

THE BARRETT DIVISION, ALLIED CHEMICAL AND DYE CORPORATION
- "Use of Liquid Forms of Nitrogen for Topdressing Purposes."

CROP PROTECTION INSTITUTE
- "Peanut Disease Control and Cotton Seed Treatment Studies."

DOW CHEMICAL COMPANY
- "Cotton and Soybean Seed Treatment Studies."

INTERNATIONAL MINERALS AND CHEMICAL CORPORATION
- "Factors Affecting Maximum Response of Crops to Nitrogen."

THE NORTH CAROLINA ICE MANUFACTURING ASSOCIATION
"Effects on Nutritive Value of Packing Fresh Fruits and Vegetables in Cracked Ice."

ROHM AND HAAS COMPANY
"Peanut Disease Control Studies."

SWIFT AND COMPANY
"The Role of Cystine in Swine Rations."

TENNESSEE CORPORATION
"Peanut and Apple Disease Control Studies."

UNITED STATES RUBBER COMPANY
"Cotton and Soybean Seed Treatment Studies."

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of the

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December 1, 1945

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L. Y. Parker ..... *Foreman*
E. A. Melin ..... *Herdsman, Dairy*

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Luke A. Forrest, M.S. ..... *Assistant Soil Conservationist*
M. T. Augustine, B.S. ..... *Project Engineer*
J. O. Knott ..... *Farm Foreman*

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Herbert Allen ..... *Foreman*
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UPPER COASTAL PLAIN BRANCH STATION, ROCKY MOUNT

R. E. Currin, Jr. ..... *Assistant Director in Charge*
Wm. Allsbrook ..... *Foreman*

† The six branch station farms are owned and operated by the North Carolina Department of Agriculture, and the employees on these farms are members of the Department of Agriculture staff.

[1] In cooperation with Bureau of Plant Industry, Soils and Agricultural Engineering, USDA.
[2] In cooperation with Bureau of Animal Industry, USDA.
[3] In cooperation with Bureau of Dairy Industry, USDA.
[4] In cooperation with Bureau of Agricultural and Industrial Chemistry, USDA.
[5] In cooperation with Soil Conservation Service, USDA.
[6] In cooperation with Bureau of Agricultural Economics, USDA.
[7] In cooperation with Tennessee Valley Authority.

FINANCIAL REPORT

of the

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

FOR THE YEAR ENDED JUNE 30, 1945

CERTIFICATION

We, the undersigned, certify that the receipts and expenditures shown in this report from Federal funds and as offset to Bankhead-Jones funds are correct; that the expenditures were solely for the purposes set forth in the acts of Congress approved March 2, 1887 (Hatch), March 16, 1906 (Adams), February 24, 1925 (Purnell), May 16, 1928 (Hawaii), February 23, 1929 (Alaska), March 4, 1931 (Puerto Rico), June 29, 1935 (Bankhead-Jones, Title I), June 20, 1936 (Alaska), and March 4, 1940 (Employer Contributions to Retirement); that the expenditures are in accordance with the terms of said acts so far as applicable to this station; and that properly approved vouchers are on file for all expenditures.

We further certify that the sum of $ NONE was the total amount earned as interest on the deposit of Hatch, Adams, Purnell, and Bankhead-Jones funds and that this amount has been remitted to the Treasurer of the United States through the United States Department of Agriculture.

(Signed) L. D. BAVER,
Director of Experiment Station

(Signed) J. G. VANN,
(*Legal Custodian of Federal funds*)
Assistant Controller

Title North Carolina State College of Agriculture and Engineering

(Seal of Institution)

RECEIPTS AND EXPENDITURES

UNDER HATCH, ADAMS, PURNELL, AND BANKHEAD-JONES ACTS, AND THE STATE OFFSET REQUIRED BY THE BANKHEAD-JONES ACT

Fiscal Year Ended June 30, 1945

RECEIPTS

	Balance from 1944-45	Receipts from U. S. Treasury	Total
FEDERAL FUNDS:			
Hatch	None	$ 15,000.00	$ 15,000.00
Adams	None	15,000.00	15,000.00
Purnell	None	60,000.00	60,000.00
Bankhead-Jones	None	106,085.56	106,085.56
FOR BANKHEAD-JONES OFFSET			259,407.49

EXPENDITURES

PURPOSE	FUND			
	Hatch	Adams	Purnell	Bankhead-Jones
Personal Services:				
Administration	$12,714.48			
For all other purposes		$12,803.24	$46,109.65	$ 86,287.32
Travel	636.24	392.23	3,144.80	3,670.80
Transportation of Things	8.74	11.42	18.32	155.29
Communication Service	76.09	8.26	315.05	280.68
Rents and Utility Service:				
Heat, Light, power, water, gas electricity	9.50		13.20	129.22
Rent of space in buildings or equipment			1,000.00	1.66
Rent of land				677.50
Printing and Binding:				
Printing publications	450.00		315.73	137.06
Other printing and binding			171.33	90.05
Other Contractual Services:				
Repairs and alterations to equipment, and other contractual services not otherwise classified	173.95	352.49	723.49	1,877.54
Repairs and alterations to buildings (not capital improvements)				85.00
Supplies and Materials:				
Used in construction, repair, or alteration of buildings	1.32		3.67	33.12
Other supplies and materials	736.60	847.72	5,797.35	9,212.47
Equipment	193.08	584.64	2,387.41	3,197.85
Building and fixed equipment				250.00
TOTAL EXPENDITURES	$15,000.00	$15,000.00	$60,000.00	$106,085.56

NON-FEDERAL FUNDS

Fiscal Year Ended June 30, 1945

FUNDS AVAILABLE

	For All Purposes	For Agricultural Investigations
State appropriations or allotments:		
Main station	$187,426.25	$178,626.25
Sales	44,496.40	44,496.40
Miscellaneous: Commercial Gifts	20,114.62	20,114.62
Balance brought forward from previous year (All sources)	16,170.22	16,170.22
TOTAL	$268,207.49	$259,407.49

CLASSIFICATION OF EXPENDITURES FOR AGRICULTURAL INVESTIGATIONS

Personal Services	$152,727.24
Travel	8,945.84
Transportation of Things	625.20
Communication Service	2,526.15
Rents and Utility Services	3,691.64
Printing and Binding	3,771.50
Other Contractual Services	9,601.60
Supplies and Materials	40,064.71
Equipment	17,180.70
Lands and Structures (Contractual)	1,953.90
TOTAL EXPENDITURES	$241,088.48
Unexpended balance	18,319.01
TOTAL FUNDS AVAILABLE	$259,407.49

THE AGRICULTURAL EXPERIMENT STATION
OF THE
NORTH CAROLINA STATE COLLEGE OF AGRICULTURE AND ENGINEERING
AND
NORTH CAROLINA DEPARTMENT OF AGRICULTURE, COOPERATING
L. P. BAVER, Director
STATE COLLEGE STATION
RALEIGH